NASA/SP—1998–7037/SUPPL373
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AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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Typical Report Citation and Abstract

❶ **19970001126** NASA Langley Research Center, Hampton, VA USA
❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**
❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
❹ Mar. 1996; 130p; In English
❺ Contract(s)/Grant(s): RTOP 505-68-70-04
❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10’ to 50’, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65’ swept forebody serrations tended to roll together, while vortices from 40’ swept serrations were more effective in generating additional lift caused by their more independent nature.
❽ Author
❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

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AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 373)

MAY 1, 1998

01
AERONAUTICS

19980020602 Naval Postgraduate School, Monterey, CA USA
Commercial Technology for Aviation Configuration Management
White, P. S., Naval Postgraduate School, USA; Jun. 1997; 78p; In English
Report No.(s): AD-A331669; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This thesis examines the current policy and procedures used to manage naval aviation configuration control. It recommends that the Navy consult with SABRE Decision Technologies, or a company with a similar background, to re-engineer the process for approving configuration changes and create an information technology system to manage the process. During this study, I have identified two major challenges to naval aviation configuration policy. They are: (1) the process used to review and approve Engineering Change Proposals (ECPs) is too complex and has too many stakeholders and (2) the current method for management of approved configuration changes is man-hour intensive, has potential for administrative error, and requires physical inspection to positively verify aircraft and equipment configurations. Finally, this study presents the theory that there are many common requirements between naval aviation maintenance and commercial airline maintenance. We should take advantage of the experience and technological innovations of industry and use them to make our configuration policy, and our entire maintenance effort, more effective for the users in the fleet.
DTIC
Configuration Management; Military Aviation; Technology Utilization

19980020615
First successful simulation of on-board explosion will aid in aircraft hardening studies
Chen, Victor L., McDonnell-Douglas Aerospace, USA; Simulation; February, 1997; ISSN 0037-5497; Volume 68, no. 2, pp. 107-110; In English; Copyright; Avail: Issuing Activity

The world's first successful simulation of an explosion on board a commercial airliner is expected to provide a significant boost to understanding how to harden airliners against bombs. An explosion of this type occurs extremely quickly and its simulation requires simultaneous operation of both a fluid and a structural code. McDonnell-Douglas engineers overcame these problems by coupling two explicit finite element codes so that the results of each are communicated to the other. The validity of this approach is supported by adequate agreement with the available experimental evidence.
Author (EI)
Computerized Simulation; Explosions; Bombs (Ordnance); Finite Element Method

19980020633 Warner Robins Air Logistics Center, Robins AFB, GA USA
PRAM Program: Robotic Paint Booth ***Final Report***
Jul. 20, 1994; 11p; In English
Report No.(s): AD-A331675; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

F-15 aircraft scheduled for Programmed Depot Maintenance (PDM) normally have 10-15 coats of paint. The aircraft must be completely stripped, inspected for corrosion, and then repainted. Air Force PDM is designed to identify and repair aircraft structural or mechanical problems before they become critical. The FY89 PDM package for F-15s required a minimum of 100 aircraft per year and a potential workload of 850 aircraft over the next five years (maximum 170 per year) to be accomplished at Warner Robins. This task was only supportable with additional manhours, equipment, and facilities, or a more efficient, less manpower-intensive method for PDM. Warner Robins firmly believed that an automated preparation and paint system could be developed which would meet all the Air Force quality and safety requirements and eliminate the F-15 support problem. In designing the sys-

tem, it was discovered that the size of existing robots was not sufficient to reach all parts of an F-15 aircraft with the robot stationary. The only solution was to move the robot itself in three dimensional space. This solution added complexity because each additional degree of freedom required an additional input and output to be controlled. to spray paint from above, below, and around the aircraft, a platform-on-a-curved-track configuration was selected. to wash, etch, and alodine, a gantry system concept was chosen for fast and complete coverage. This project was initiated in 1988, cost $4.9M, and was funded with FY89 and FY90 dollars. The system was placed in use for production painting of PDM aircraft at Robins AFB in January 1993. The concept of robotic aircraft surface preparation and painting was demonstrated to be feasible. The prototype system installed at Robins continues to be optimized for production, while being fully production capable.
DTIC
F-15 Aircraft; Aircraft Maintenance; Robots

19980021612
Keisho of development technology: the case of the Japanese aircraft industry
Nakayama, T.; Journal of Product Innovation Management; September, 1997; ISSN 0737-6782; Volume 14, no. 5, pp. 393-405; In English; Copyright; Avail: Issuing Activity

The paper explores the role that 'keisho' - or inheritance - of development technology plays in the Japanese aircraft industry. The concept of 'keisho' is illustrated through examples ranging from the projects that culminated in development of the famed Zero fighter aircraft during the 1930s to those that produced the FSX (recently renamed the F-2) support fighter during 1990s. Drawing on these historical perspectives, the paper addresses three key questions regarding 'keisho'.
Author (revised by EI)
Aircraft Industry; Management; Industries; Technologies

19980022955
Applications of probabilistic methods to aircraft structural maintenance
Yang, J. N., California Univ., Irvine, USA; Manning, S. D., General Dynamics Corp., USA; 1992, pp. 127-142; In English; Copyright; Avail: Aeroplus Dispatch

A stochastic crack growth analysis (SCGA) methodology, based on the lognormal random variable model, is described and demonstrated for two practical aircraft structural maintenance applications. In the first application, a reliability centered maintenance analysis (RCMA) for evaluating aircraft structural maintenance and supportability requirements and options in terms of risk or reliability is demonstrated. The sensitivity of RCMA inspections (initial and reinspection intervals) to variations in analysis variables is investigated using a cutout in an aluminum-lithium cheek frame. The second application is the maintenance scheduling for a fleet of aircraft on a calendar year basis in terms of risk or reliability. The crack growth life dispersion due to material, service usage severity and aircraft utilization rate on the fleet maintenance schedule are accounted for. Aircraft fleet tracking data are used, and the sensitivity of fleet maintenance requirements to variations in the design stress levels and other variables are investigated and presented.
Author (AIAA)
Aircraft Maintenance; Probability Theory; Crack Propagation; Reliability Analysis

02
AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

19980019443 NASA Ames Research Center, Moffett Field, CA USA
Experimental Study of Lift-Enhancing Tabs on a Two-Element Airfoil
Storms, Bruce L., Sterling Software, Inc., USA; Ross, James C., NASA Ames Research Center, USA; Journal of Aircraft; Oct. 1995; Volume 32, No. 5, pp. 1072-1078; In English; 12th; Applied Aerodynamics Conference, 20-23 Jun. 1994, Colorado Springs, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): NASA/TM-95-207303; NAS 1.15:207303; AIAA Paper 94-1868; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A01, Microfiche

The results of a wind-tunnel test are presented for a two-dimensional NASA 63(sub 2)-215 Mod B airfoil with a 30% chord single-slotted flap. The use of lift-enhancing tabs (similar to Gurney flaps) on the lower surface near the trailing edge of both elements was investigated on four nap configurations. A combination of vortex generators on the flap and lift-enhancing tabs was also investigated. Measurements of surface-pressure distributions and wake profiles were used to determine the aerodynamic per-

formance of each configuration. By reducing flow separation on the flap, a lift-enhancing tab at the main-element trailing edge increased the maximum lift by 10.3% for the 42-deg flap case. The tab had a lesser effect at a moderate flap deflection (32 deg) and adversely affected the performance at the smallest flap deflection (22 deg). A tab located near the flap trailing edge produced an additional lift increment for all flap deflections. The application of vortex generators to the flap eliminated lift-curve hysteresis and reduced flow separation on two configurations with large flap deflections (greater than 40 deg). A maximum-lift coefficient of 3.32 (17% above the optimum baseline) was achieved with the combination of lift-enhancing tabs on both elements and vortex generators on the flap.
Author
Wind Tunnel Tests; Airfoils; Flaps (Control Surfaces); Lift; Pressure Distribution

19980019444 NASA Ames Research Center, Moffett Field, CA USA
Numerical Simulation of Forced and Free-to-Roll Delta-Wing Motions
Chaderjian, Neal M., NASA Ames Research Center, USA; Schiff, Lewis B., NASA Ames Research Center, USA; Journal of Aircraft; Feb. 1996; Volume 33, No. 1, pp. 93-99; In English; 12th; 12th Applied Aerodynamics Conference, 20-23 Jun. 1994, Colorado Springs, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): NASA/TM-96-207294; NAS 1.15:207294; AIAA Paper 94-1884; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The three-dimensional, Reynolds-averaged, Navier-Stokes (RANS) equations are used to numerically simulate nonsteady vortical flow about a 65-deg sweep delta wing at 30-deg angle of attack. Two large-amplitude, high-rate, forced-roll motions, and a damped free-to-roll motion are presented. The free-to-roll motion is computed by coupling the time-dependent RANS equations to the flight dynamic equation of motion. The computed results are in good agreement with the forces, moments, and roll-angle time histories. Vortex breakdown is present in each case. Significant time lags in the vortex breakdown motions relative to the body motions strongly influence the dynamic forces and moments.
Author
Reynolds Averaging; Navier-Stokes Equation; Computational Fluid Dynamics; Unsteady Flow; Swept Wings; Vortex Breakdown; Flow Distribution

19980019445 NASA Ames Research Center, Moffett Field, CA USA
Navier-Stokes Computations on Full Wing-Body Configuration with Oscillating Control Surfaces
Obayashi, Shigeru, NASA Ames Research Center, USA; Chiu, Ing-Tsau, NASA Ames Research Center, USA; Guruswamy, Guru P., NASA Ames Research Center, USA; Journal of Aircraft; Dec. 1995; Volume 32, No. 6, pp. 1227-1233; In English; Atmospheric Flight Mechanics Conference, 9-11 Aug. 1993, Monterey, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): NASA/TM-95-207298; NAS 1.15:207298; AIAA Paper 93-3687; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Unsteady Navier-Stokes simulations have been performed for vortical flows over an "arrow-wing" configuration of a supersonic transport in the transonic regime. Computed steady pressures and integrated force coefficients with and without control surface deflection at a moderate angle of attack are compared with experiment. For unsteady cases, oscillating trailing-edge control surfaces are modeled by using moving grids. Response characteristics between symmetric and antisymmetric oscillatory motions of the control surfaces on the left and right wings are studied. The antisymmetric case produces higher lift than the steady case with no deflection and the unsteady symmetric case produces higher lift than the antisymmetric case. The detailed analysis of the wake structure revealed a strong interaction between the primary vortex and the wake vortex sheet from the flap region when the flap is deflected up.
Author
Control Surfaces; Navier-Stokes Equation; Computational Fluid Dynamics; Transonic Flow; Angle of Attack; Arrow Wings; Reynolds Averaging

19980019506 Arizona State Univ., Dept. of Mechanical and Aerospace Engineering, Tempe, AZ USA
Effects of Suction on Swept-Wing Transition ***Final Report, 16 Dec. 1995 - 31 Mar. 1998***
Saric, William S., Arizona State Univ., USA; Feb. 1998; 508p; In English
Contract(s)/Grant(s): NAG1-194
Report No.(s): NASA/CR-1998-206838; NAS 1.26:206838; No Copyright; Avail: CASI; A22, Hardcopy; A04, Microfiche

Stability experiments are conducted in the Arizona State University Unsteady Wind Tunnel on a 45 deg swept airfoil. The pressure gradient is designed to provide purely crossflow-dominated transition; that is, the boundary layer is subcritical to Toll-

mien-Schlichting disturbances. The airfoil surface is hand polished to a 0.25 microns rms finish. Under these conditions, stationary crossflow disturbances grow to nonuniform amplitude due to submicron surface irregularities near the leading edge. Uniform stationary crossflow waves are produced by controlling the initial conditions with spanwise arrays of micron-sized roughness elements near the attachment line. Hot-wire measurements provide detailed maps of the crossflow wave structure, and accurate spectral decompositions isolate individual-mode growth rates for the fundamental and harmonic disturbances. Roughness spacing, roughness height, and Reynolds number are varied to investigate the growth of all amplified wavelengths. The measurements show early nonlinear mode interaction causing amplitude saturation well before transition. Comparisons with nonlinear parabolized stability equations calculations show excellent agreement in both the disturbance amplitude and the mode-shape profiles.
Author
Experimentation; Swept Wings; Suction; Surface Defects; Cross Flow; Airfoils

19980019572 NASA Ames Research Center, Moffett Field, CA USA
Comparison of Implicit Schemes for the Incompressible Navier-Stokes Equations
Rogers, Stuart E., NASA Ames Research Center, USA; AIAA Journal; Nov. 1995; Volume 33, No. 11, pp. 2066-2072; In English; 33rd; Aerospace Sciences Meeting, 9-12 Jan. 1995, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): NASA/TM-95-207299; NAS 1.15:207299; AIAA Paper 95-0567; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

For a computational flow simulation tool to be useful in a design environment, it must be very robust and efficient. to develop such a tool for incompressible flow applications, a number of different implicit schemes are compared for several two-dimensional flow problems in the current study. The schemes include Point-Jacobi relaxation, Gauss-Seidel line relaxation, incomplete lower-upper decomposition, and the generalized minimum residual method preconditioned with each of the three other schemes. The efficiency of the schemes is measured in terms of the computing time required to obtain a steady-state solution for the laminar flow over a backward-facing step, the flow over a NACA 4412 airfoil, and the flow over a three-element airfoil using overset grids. The flow solver used in the study is the INS2D code that solves the incompressible Navier-Stokes equations using the method of artificial compressibility and upwind differencing of the convective terms. The results show that the generalized minimum residual method preconditioned with the incomplete lower-upper factorization outperforms all other methods by at least a factor of 2.
Author
Incompressible Flow; Navier-Stokes Equation; Computational Fluid Dynamics; Two Dimensional Flow; Reynolds Averaging

19980019883 VDI-Verlag G.m.b.H., Duesseldorf, Germany
Experimental Investigation of Nonlinear Formation of Flow Structures in a Transitional Three-Dimensional Boundary Layer ***Experimentelle Untersuchung Nichtlinearer Strukturbildung im Transitionsprozeff Einer Instabilen Dreidimensionalen Grenzschicht***
Lerche, Thomas, VDI-Verlag G.m.b.H., Germany; 1997; ISSN 0178-9538; 124p; In German; ISBN 3-18-331007-4; Copyright; Avail: Issuing Activity (VDI-Verlag G.m.b.H., Postfach 10 10 54, 40001Duesseldorf, Germany), Hardcopy, Microfiche

Utilizing a newly developed disturbance generator which enables the initiation of single oblique traveling waves in a three-dimensional incompressible boundary-layer being subject to crossflow instability, the primary and secondary transition regimes are investigated by hot-wire anemometry. Measurements of propagation directions and amplification characteristics of primary crossflow instabilities are presented. Strong interactions known as parametric resonance between stationary and unsteady crossflow modes are investigated. Secondary resonance effects leading to the generation of additionally amplified modes, resonant wave triads and flow randomization are accounted for. Proper Orthogonal Decomposition (POD) is used to identify coherent structures in the nonlinear transition regime. A high-frequency secondary instability in the regime immediately before breakdown to turbulence is analysed. Experimental findings of primary instability development are compared with local and non-local linear stability calculations. The discussion of results concerning nonlinear disturbance evolution is based on an interaction model from spatial Direct Numerical Simulation (DNS) and predictions of secondary instability theory.
Author
Three Dimensional Boundary Layer; Nonlinearity; Cross Flow; Traveling Waves; Turbulence; Stability; Decomposition

19980020537 Academy of Sciences of the Ukraine, Inst. of Hydromechanics, Kiev, Ukraine
Non-Linear Nonsteady Effects in the Hydrodynamics of the Oscillating Wing
Dovgiy, S. A., Academy of Sciences of the Ukraine, Ukraine; Feb. 1998; 9p; In English; Also announced as 19980020532; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The article presents the analysis of the nonsteady hydroaerodynamic characteristics of the oscillating wing with the infinite span performing the function of the propulsor. The results are received for the non-linear theory by means of the discrete vortices method. The comparison of data is conducted based on the quasisteady approach, linear and non-linear theories. It is also noted that for those modes of the wing motion which are able to simulate the operation of the wing propulsors of hydrobionts valid results can be given with the help of the nonsteady theory only.
Author
Nonlinearity; Oscillating Flow; Vortices; Infinite Span Wings; Hydrodynamics

19980020855 NASA Langley Research Center, Hampton, VA USA
Aeroheating Predictions for X-34 Using an Inviscid-Boundary Layer Method
Riley, Christopher J., NASA Langley Research Center, USA; Kleb, William L., NASA Langley Research Center, USA; Alter, Steven J., Lockheed Martin Engineering and Sciences Co., USA; 1998; 14p; In English; 36th; Aerospace Sciences Meeting and Exhibit, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): NASA/TM-1998-207288; NAS 1.15:207288; AIAA Paper 98-0880; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Radiative equilibrium surface temperatures and surface heating rates from a combined inviscid-boundary layer method are presented for the X-34 Reusable Launch Vehicle for several points along the hypersonic descent portion of its trajectory. Inviscid, perfect-gas solutions are generated with the Langley Aerothermodynamic Upwind Relaxation Algorithm (LAURA) and the Data-Parallel Lower-Upper Relaxation (DPLUR) code. Surface temperatures and heating rates are then computed using the Langley Approximate Three-Dimensional Convective Heating (LATCH) engineering code employing both laminar and turbulent flow models. The combined inviscid-boundary layer method provides accurate predictions of surface temperatures over most of the vehicle and requires much less computational effort than a Navier-Stokes code. This enables the generation of a more thorough aerothermal database which is necessary to design the thermal protection system and specify the vehicle's flight limits.
Author
Inviscid Flow; Boundary Layers; X-34 Reusable Launch Vehicle; Surface Temperature; Turbulent Flow; Convective Heat Transfer; Aerodynamic Heating; Algorithms

19980020894 NASA Ames Research Center, Moffett Field, CA USA
Wing-Body Aeroelasticity on Parallel Computers
Guruswamy, Guru P., NASA Ames Research Center, USA; Byun, Chansup, MCAT Inst., USA; Journal of Aircraft; Apr. 1996; Volume 33, No. 2, pp. 421-428; In English; 35th; Structures, Structural Dynamics and Materials Conference, 18-20 Apr. 1994, Hilton Head, SC, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NCC2-740
Report No.(s): NASA/TM-96-207291; NAS 1.15:207291; AIAA Paper 94-1487; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This article presents a procedure for computing the aeroelasticity of wing-body configurations on multiple-instruction, multiple-data parallel computers. In this procedure, fluids are modeled using Euler equations discretized by a finite difference method, and structures are modeled using finite element equations. The procedure is designed in such a way that each discipline can be developed and maintained independently by using a domain decomposition approach. A parallel integration scheme is used to compute aeroelastic responses by solving the coupled fluid and structural equations concurrently while keeping modularity of each discipline. The present procedure is validated by computing the aeroelastic response of a wing and comparing with experiment. Aeroelastic computations are illustrated for a high speed civil transport type wing-body configuration.
Author
Body-Wing Configurations; Aeroelasticity; Parallel Computers; Euler Equations of Motion; Measure and Integration; Finite Difference Theory; Finite Element Method

19980020902 NASA Langley Research Center, Hampton, VA USA
Numerical Simulation of Fluctuations Leading to Noise in a Flap-Edge Flowfield
Streett, C. L., NASA Langley Research Center, USA; 1998; 16p; In English; 36th; Aerospace Sciences Meeting and Exhibit, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): NASA/TM-1998-207324; NAS 1.15:207324; AIAA Paper 98-0628; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this paper we develop an approximate computational framework for simulation of the fluctuating flowfield associated with the complex vortex system seen at the side edge of a flap in a multi-element high-lift airfoil system. The eventual goal of these

simulations is to provide an estimate of the spectral content of these fluctuations, in order that the spectrum of the noise generated by such flowfields may be estimated. Results from simulations utilizing this computational framework are shown.
Author
Numerical Analysis; Simulation; Flow Distribution

19980021270 NASA Langley Research Center, Hampton, VA USA
Engineering Aerothermal Analysis for X-34 Thermal Protection System Design
Wurster, Kathryn E., NASA Langley Research Center, USA; Riley, Christopher J., NASA Langley Research Center, USA; Zoby, E. Vincent, NASA Langley Research Center, USA; 1998; 22p; In English; 36th; Aerospace Sciences Meeting and Exhibit, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): NASA/TM-1998-207310; NAS 1.15:207310; AIAA Paper 98-0882; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Design of the thermal protection system for any hypersonic flight vehicle requires determination of both the peak temperatures over the surface and the heating-rate history along the flight profile. In this paper, the process used to generate the aerothermal environments required for the X-34 Testbed Technology Demonstrator thermal protection system design is described as it has evolved from a relatively simplistic approach based on engineering methods applied to critical areas to one of detailed analyses over the entire vehicle. A brief description of the trajectory development leading to the selection of the thermal protection system design trajectory is included. Comparisons of engineering heating predictions with wind-tunnel test data and with results obtained using a Navier- Stokes flowfield code and an inviscid/boundary layer method are shown. Good agreement is demonstrated among all these methods for both the ground-test condition and the peak heating flight condition. Finally, the detailed analysis using engineering methods to interpolate the surface-heating-rate results from the inviscid/boundary layer method to predict the required thermal environments is described and results presented.
Author
Aerothermodynamics; Boundary Layers; Thermal Analysis; Systems Engineering; Hypersonic Vehicles; Flight Paths; X-34 Reusable Launch Vehicle

19980021273 NASA Ames Research Center, Moffett Field, CA USA
Analysis of Tangential Slot Blowing on F/A-18 Isolated Forebody
Gee, Ken, NASA Ames Research Center, USA; Rizk, Yehia M., NASA Ames Research Center, USA; Schiff, Lewis B., NASA Ames Research Center, USA; Journal of Aircraft; Oct. 1995; Volume 32, No. 5, pp. 1040-1046; In English; 12th; Applied Aerodynamics Conference, 20-23 Jun. 1994, Colorado Springs, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): NASA/TM-95-207378; NAS 1.15:207378; AIAA Paper 94-1831; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The generation of significant side forces and yawing moments on an F/A-18 fuselage through tangential slot blowing is analyzed using computational fluid dynamics. The effects of freestream Mach number, jet exit conditions, jet length, and jet location are studied. The effects of over- and underblowing on force and moment production are analyzed. Non-time-accurate solutions are obtained to determine the steady-state side forces, yawing moments, and surface pressure distributions generated by tangential slot blowing. Time-accurate solutions are obtained to study the force onset time lag of tangential slot blowing. Comparison with available experimental data from full-scale wind-tunnel and subscale wind-tunnel tests are made. This computational analysis complements the experimental results and provides a detailed understanding of the effects of tangential slot blowing on the flowfield about the isolated F/A-18 forebody. Additionally, it extends the slot-blowing database to transonic maneuvering Mach numbers.
Author
Analysis (Mathematics); Tangential Blowing; Slots; Computational Fluid Dynamics; Yawing Moments; Forebodies; Free Flow

19980021295 NASA Ames Research Center, Moffett Field, CA USA
Impulsive Start of a Symmetric Airfoil at High Angle of Attack
Katz, Joseph, San Diego State Univ., USA; Yon, Steven, San Diego State Univ., USA; Rogers, Stuart E., NASA Ames Research Center, USA; AIAA Journal; Feb. 1996; Volume 34, No. 2, pp. 225-230; In English; 13th; Applied Aerodynamics Conference, 19-22 Jun. 1995, San Diego, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NCA2-786
Report No.(s): NASA/TM-96-207292; NAS 1.26:207292; AIAA Paper 95-1872; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The fluid dynamic phenomena following the impulsive start of a NACA 0015 airfoil were studied by using a time accurate solution of the incompressible laminar Navier-Stokes equations. Angle of attack was set at 10 deg to simulate steady-state poststall conditions at a Reynolds number of 1.2 x 10(exp 4). The calculation revealed that large initial lift values can be obtained, immediately following the impulsive start, when a trapped vortex develops above the airfoil. Before the buildup of this trapped vortex and immediately after the airfoil was set into motion, the fluid is attached to the airfoil's surface and flows around the trailing edge, demonstrating the delay in the buildup of the classical Kutta condition. The transient of this effect is quite short and is followed by an attached How event that leads to the trapped vortex that has a longer duration. The just described initial phenomenon eventually transits into a fully developed separated flow pattern identifiable by an alternating, periodic vortex shedding.
Author
Airfoils; Navier-Stokes Equation; Angle of Attack; Incompressible Flow; Vortex Shedding

19980021427 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
Directional Agglomeration Multigrid Techniques for High Reynolds Number Viscous Flow Solvers
1998; 8p; In English; 36th; Aerospace Sciences Meeting and Exhibit, 12-15 Jan. 1998, Reno, NV, USA
Report No.(s): NASA/CR-1998-207313; NAS 1.26:207313; AIAA Paper 98-0612; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A01, Microfiche

A preconditioned directional-implicit agglomeration algorithm is developed for solving two- and three-dimensional viscous flows on highly anisotropic unstructured meshes of mixed-element types. The multigrid smoother consists of a pre-conditioned point- or line-implicit solver which operates on lines constructed in the unstructured mesh using a weighted graph algorithm. Directional coarsening or agglomeration is achieved using a similar weighted graph algorithm. A tight coupling of the line construction and directional agglomeration algorithms enables the use of aggressive coarsening ratios in the multigrid algorithm, which in turn reduces the cost of a multigrid cycle. Convergence rates which are independent of the degree of grid stretching are demonstrated in both two and three dimensions. Further improvement of the three-dimensional convergence rates through a GMRES technique is also demonstrated.
Author
Agglomeration; Multigrid Methods; High Reynolds Number; Viscous Flow

19980021432 NASA Langley Research Center, Hampton, VA USA
Computational Aeroheating Predictions for X-34
Kelb, William L., NASA Langley Research Center, USA; Wood, William A., NASA Langley Research Center, USA; Gnoffo, Peter A., NASA Langley Research Center, USA; Alter, Stephen J., Lockheed Martin Engineering and Sciences Co., USA; 1998; 14p; In English; 36th; AIAA Aerospace Sciences Meeting and Exhibit, 12-15 Jan. 1998, Reno, NV, USA; Original contains color illustrations
Report No.(s): NASA/TM-1998-207318; NAS 1.15:207318; AIAA Paper 98-0879; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Radiative equilibrium surface temperatures, heating rates, streamlines, surface pressures, and flow-field features as predicted by the Langley Aerothermodynamic Upwind Relaxation Algorithm (Laura) are presented for the X-34 Technology Demonstrator. Results for two trajectory points corresponding to entry peak heating and two control surface deflections are discussed. This data is also discussed in context of Thermal Protection System (TPS) design issues. The work presented in this report is part of a larger effort to define the X-34 aerothermal environment, including the application of engineering codes and wind-tunnel studies.
Author
Aerodynamic Heating; X-34 Reusable Launch Vehicle; Computational Fluid Dynamics; Upwind Schemes (Mathematics)

19980021507
Numerical study of the effects of wall catalysis on shock wave/boundary-layer interaction
Grumet, Adam, Maryland, Univ., College Park, USA; Anderson, John D., Jr., Maryland, Univ., College Park; Lewis, Mark J., Maryland, Univ., College Park; Journal of Thermophysics and Heat Transfer; Mar. 1994; ISSN 0887-8722; Volume 8, no. 1, pp. 40-47; In English
Contract(s)/Grant(s): AF-AFOSR-88-0101; NAG2-529; Copyright; Avail: Aeroplus Dispatch

This article presents a numerical study to investigate the effects of nonequilibrium chemistry, and in particular, wall catalysis on the separated flow region generated by an oblique shock wave impinging upon a flat plate boundary layer for a highly dissociated air flowfield. The results focus on the effects of the nonequilibrium chemistry upon the surface heat transfer and the separation zone size. Comparative results are given for chemically reacting both noncatalytic and fully catalytic walls and nonreacting flow cases. A direct comparison of all three cases at low pressures reveals a minimal change in the peak heat transfer for the nonca-

talytic wall case as compared in the calorically perfect gas case. In contrast, the fully catalytic wall exerted a tremendous increase in the surface heat transfer. However, as the freestream pressure is increased, significant recombination occurs, so the increase in the peak heat transfer for the noncatalytic wall is more pronounced.
Author (AIAA)
Boundary Layers; Shock Wave Interaction; Separated Flow; Reacting Flow; Nonequilibrium Conditions; Catalysis

19980021721
Recent advances in jet flowfield simulation. I - Steady flows
Dash, S. M., Science Applications International Corp., Propulsive Sciences Div., USA; Kenzakowski, D. C., Science Applications International Corp., Propulsive Sciences Div., USA; Seiner, J. M., NASA Langley Research Center, USA; Bhat, T. R. S., NASA Langley Research Center, USA; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4390; Copyright; Avail: Aeroplus Dispatch

This paper considers the balanced-pressure round jet and describes validated methodology to predict its meanflow structure under varied conditions. The simulation of hot supersonic jets is emphasized which has required upgrades to the k-epsilon turbulence model to provide consistent agreement with available fluid dynamic data. Upgrades to k-epsilon have involved the unification of vortex-stretching and compressible-dissipation extensions. Earlier studies have indicated the promise of utilizing this fluid dynamic methodology in conjunction with the solution of the compressible Rayleigh equation for the prediction of supersonic jet noise associated with Mach wave emission. Work towards unifying these steps is described along with recent predictions which implement the final version of the new k-epsilon CDJ turbulence model. Progress towards analyzing the mean flow structure of more complicated jets is summarized along with current limitations in the turbulence modeling and potential research paths towards remedying these limitations.
Author (revised by AIAA)
Jet Flow; Flow Distribution; K-Epsilon Turbulence Model; Turbulent Flow; Computational Fluid Dynamics

19980022084
Trailing-edge diffraction - Inviscid and viscid theory
Peake, N., Cambridge Univ., UK; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4394; Copyright; Avail: Aeroplus Dispatch

The theoretical analysis described in this paper involves an investigation of vortex shedding by a supersonic jet nozzle. We consider a two-dimensional rigid splitter plate, with supersonic mean flow on one side and still air on the other, and with a plane sound wave illuminating the trailing edge from the supersonic stream, and analyze both the inviscid (outer) and viscid (inner) unsteady flows so generated. We demonstrate that for typical values of incident frequency and amplitude, there is a fully-consistent, attached-flow solution, in which the vortex sheet leaves the trailing edge with nonzero gradient, and for which the viscous flow possesses the well-known triple-deck structure. Determination of this viscous flow reduces to the solution of equations in the lower deck, which is completed using a blend of analytical and numerical methods.
Author (AIAA)
Trailing Edges; Supersonic Nozzles; Jet Nozzles; Vortex Shedding; Sound Waves; Aeroacoustics

19980022086
Recent advances in jet flowfield simulation. II - Unsteady flows
Sinha, N., Science Applications International Corp., Propulsive Sciences Div., USA; Dash, S. M., Science Applications International Corp., Propulsive Sciences Div., USA; Madabhushi, R. K., Science Applications International Corp., Propulsive Sciences Div., USA; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4391; Copyright; Avail: Aeroplus Dispatch

This paper describes recent advances made in analyzing a variety of unsteady jet/free shear flow problems. The CRAFT upwind/implicit code has been utilized with turbulent large scale structures directly simulated while the finer, dissipative scales are modeled using subgrid stress (SGS) terms. Problems addressed include short-duration jets, quasi-periodic flows, and weakly forced shear layers. This approach has been utilized to gain an understanding of time-averaged turbulence structure in an asymptotic state, for which sensitivities to weak forcing and SGS modeling have been quite small. For periodic problems (e.g., vortex-shedding), the low frequency spectral behavior (controlled by the large scale structure) is minimally affected by SGS modeling while the high frequency spectra are strongly influenced. The importance of SGS terms in short-duration problems is demonstrated by work being performed for interior ballistic flows.
Author (AIAA)
Jet Flow; Unsteady Flow; Free Flow; Flow Distribution; Turbulence Models; Vortices

19980022096

Adaptive boundary layer control with distributed suction

Rioual, J.-L., Southampton Univ., UK; Nelson, P. A., Southampton Univ., UK; Fisher, M. J., Southampton Univ., UK; Mullender, A. J., Rolls-Royce, PLC, UK; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4396; Copyright; Avail: Aeroplus Dispatch

An iterative control algorithm is derived allowing the output of a multiinput/single output system to be driven towards a desired value with minimum power penalty on the inputs. The derived optimal controller is applied to the control of the zone of transition for a flat plate boundary layer with pressure gradient. The control is applied using suction through two independently controlled suction panels. Experimental results show that for such a nonlinear time-varying system, boundary layer transition can be maintained at a desired location using the minimum suction distribution. The key element for good performance of the controller is the identification algorithm which must ensure accurate parameters of the model of the unknown plant. The controller update is indeed fully dependent on the derived model parameters. The application of the control algorithm to computer models of five and nine suction panels shows that convergence towards the optimal suction distribution can easily be achieved with a number of iterations.

Author (AIAA)

Boundary Layer Control; Boundary Layer Transition; Iteration; Control Systems Design; Controllers

19980022106

Supersonic elliptic jet noise - Experiments with and without an ejector shroud

Kinzie, Kevin W., Pennsylvania State Univ., University Park, USA; Martens, Steven, Pennsylvania State Univ., University Park; McLaughlin, Dennis K., Pennsylvania State Univ., University Park; Oct. 1993; In English

Contract(s)/Grant(s): NAG1-1047

Report No.(s): AIAA Paper 93-4349; Copyright; Avail: Aeroplus Dispatch

Experiments have been performed to investigate the aerodynamic and acoustic properties of a moderate Reynolds number, shock-free, Mach 1.5 elliptic jet. The elliptic jet is seen to mix faster than a comparable axisymmetric jet, resulting in a shorter potential core. As a result of the faster jet deceleration, less noise is radiated to the far-field of the elliptic jet compared to the axisymmetric jet. Higher flow fluctuations are measured on the minor axis of the jet shear layer than the major axis, which appears to result in a higher noise level radiated to the far-field of the minor axis measurement plane. A modal decomposition performed around the jet azimuth shows the jet to be dominated by a varicose instability mode. Limited far-field attenuation was seen when a rectangular shroud was placed around the jet. A noise reduction of 1 to 2 dB was measured compared to the unshrouded jet.

Author (AIAA)

Supersonic Flow; Jet Flow; Aerodynamic Noise; Sound Fields; Sound Pressure; Noise Reduction

19980022169 Georgia Inst. of Tech., Aerospace and Transportation Lab., Atlanta, GA USA

Continued Development and Application of Circulation Control Pneumatic Technology to Advanced Transport Aircraft

Final Report, 14 Jun. 1993 - 31 Aug. 1997

Englar, Robert J., Georgia Inst. of Tech., USA; Mar. 03, 1998; 45p; In English

Contract(s)/Grant(s): NAG1-1517

Report No.(s): NASA/CR-1998-207471; NAS 1.26:207471; GTRI-A-9483; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Personnel of the Georgia Tech Research Institute (GTRI) Aerospace and Transportation Lab have completed a four-year grant program to develop and evaluate the pneumatic aerodynamic technology known as Circulation Control (CC) or Circulation Control Wing (CCW) for advanced transport aircraft. This pneumatic technology, which employs low-level blowing from tangential slots over round or near-round trailing edges of airfoils, greatly augments the circulation around a lifting or control surface and thus enhances the aerodynamic forces and moments generated by that surface. Two-dimensional force augmentations as high as 80 times the input blowing momentum coefficient have been recorded experimentally for these blown devices, thus providing returns of 8000% on the jet momentum expended. A further benefit is the absence of moving parts such as mechanical flaps, slats, spoilers, ailerons, elevators and rudders from these pneumatic surfaces, or the use of only very small, simple, blown aerodynamic surfaces on synergistic designs which integrate the lift, drag and control surfaces. The application of these devices to advanced aircraft can offer significant benefits in their performance, efficiency, simplicity, reliability, economic cost of operation, noise reduction, and safety of flight. to further develop and evaluate this potential, this research effort was conducted by GTRI under

grant for the NASA Langley Research Center, Applied Aerodynamics Division, Subsonic Aerodynamics Branch, between June 14, 1993 and May 31, 1997.
Author
Technologies; Aerodynamics; Pneumatics; Airfoils; Dynamic Control; Transport Aircraft

19980022387

Flow distortion monitoring in an S-shaped intake

Weng, Peifen, Shanghai Jiaotong Univ., China; Guo, Rongwei, Nanjing Aeronautical Inst., China; Journal of Aerospace Power; Oct. 1993; ISSN 1000-8055; Volume 8, no. 4, pp. 409-411; In Chinese; Copyright; Avail: Aeroplus Dispatch

A series of experiments were carried out in an S-shaped air intake at high incidence. The observations show that the greater the incidence, the more distorted is the flow field. Further, there is a relation between high incidence, swirling flow, total pressure field, and position angle of the flow with the lowest total pressure coefficient. The position angle is given as a better detection parameter which can monitor the distorted velocity and pressure field.
Author (revised by AIAA)
Aircraft Engines; Air Intakes; Flow Distortion; Duct Geometry

19980022388

Study on existence and uniqueness of similarity transformation in cascade

Zhu, Nangou, South China Univ. of Technology, China; Xu, Liping, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Aerospace Power; Oct. 1993; ISSN 1000-8055; Volume 8, no. 4, pp. 393-395; In Chinese; Copyright; Avail: Aeroplus Dispatch

Based on the similarity theory and a two-dimensional potential equation, the existence of a similarity transformation in a cascade at different inlet Mach numbers is considered. It is shown that only for linearized two-dimensional flows there exists an exact similarity. In the case of full disturbance, only an approximate similarity can be found. The uniqueness of the similarity transformation in accordance with the inlet Mach number is also considered. The conclusion provides some theoretical basis for the similarity transformation.
Author (revised by AIAA)
Cascade Flow; Existence Theorems; Uniqueness Theorem; Transformations (Mathematics); Two Dimensional Flow

19980022392

Three-dimensional flow field inside compressor rotor tip region at near stall condition

Ma, Hongwei, Beijing Univ. of Aeronautics and Astronautics, China; Jiang, Haokang, Beijing Univ. of Aeronautics and Astronautics, China; Li, Yuchun, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Aerospace Power; Oct. 1993; ISSN 1000-8055; Volume 8, no. 4, pp. 318-322; In Chinese; Copyright; Avail: Aeroplus Dispatch

The three-dimensional flow field inside the tip region of a low-speed large-scale axial-flow compressor rotor at near stall condition was measured with the help of a five-hole conical probe driven by a rotating four-coordinate traverse mechanism. Results indicate that the radial migration of the boundary layer of the blade suction surface is strong, which induces a vortex nearby; flow separation occurs on the blade suction surface; a blade scraping vortex exists in the corner of the blade pressure surface; strong mixing occurs between boundary layers of the pressure surface and the suction surface at the median part of the rotor passage, which leads to substantial deficits of total pressure and axial velocity. All of this forms a complicated flow field in the rotor tip region.
Author (revised by AIAA)
Compressor Rotors; Three Dimensional Flow; Aerodynamic Stalling; Blade Tips; Boundary Layer Flow

19980022412

Circular-to-rectangular transition duct flow without and with inlet swirl

Reichert, Bruce A., NASA Lewis Research Center, USA; Hingst, Warren R., NASA Lewis Research Center, USA; Okiishi, Theodore H., Iowa State Univ. of Science and Technology, Ames; Journal of Propulsion and Power; Feb. 1994; ISSN 0748-4658; Volume 10, no. 1, pp. 88-94; In English; Copyright; Avail: Aeroplus Dispatch

The study reported in this article explored circular-to-rectangular transition duct flows without and with inlet swirl in order to document the effect of inlet swirl on the transition duct flowfield and to provide detailed duct flow data for comparison with numerical code predictions. A method was devised to develop a swirling solid-body rotational flow with minimal associated disturbances. Coefficients based on velocities and total and static pressures measured in cross-stream planes at four axial locations within the transition duct along with surface static pressure measurements and surface oil-film simulations are presented and discussed for both nonswirling and swirling incoming flows. In both cases the inlet centerline Mach number was 0.35. The differ-

ences between flowfields for the two cases were striking. Two pairs of counterrotating side-wall vortices appeared in the duct flow without inlet swirl. These vortices were absent in the swirling incoming flow case.
Author (revised by AIAA)
Ducted Flow; Transition Flow; Swirling; Inlet Flow; Flow Distribution

19980022413

Near-wake characteristics of various V-shaped bluff bodies

Yang, Jing-Tang, National Tsing Hua Univ., Taiwan, Province of China; Tsai, Go-Long, National Tsing Hua Univ., Taiwan, Province of China; Wang, Wen-Bin, National Tsing Hua Univ., Taiwan, Province of China; Journal of Propulsion and Power; Feb. 1994; ISSN 0748-4658; Volume 10, no. 1, pp. 47-53; In English
Contract(s)/Grant(s): NSC-77-0401-E007-15; Copyright; Avail: Aeroplus Dispatch

Mechanism of vortex shedding and turbulent flow features of the near-wake flow behind regular/irregular v-shaped bluff bodies are experimentally investigated at various airflow speeds between 10-60 m/s. With the aid of schlieren photography and a three-beam, two-component backward-scattering LDA system, the phenomena of vortex shedding and flow recirculation behind the flameholder are well illustrated. Results show Strouhal numbers, based on vortex shedding frequencies being independent of gutter shape and within a range of 0.23-0.25. A similar flow structure of flow exists among near wake flows of v-gutters with different span angles. Increase of Reynolds number monotonically reduces the size of the recirculation zone. Variation in attack angle only slightly changes mean flow features but enhances normalized Reynolds shear stresses in the near-wake.
Author (AIAA)
Bluff Bodies; Near Wakes; Turbulent Flow; Vortex Shedding; Recirculative Fluid Flow

19980022429

A new method for solving local flow near leading or trailing edge of an airfoil

Liu, Gaolian, Shanghai Inst. of Mechanical Engineering, China; He, Hong, Shanghai Inst. of Mechanical Engineering, China; Journal of Aerospace Power; Oct. 1993; ISSN 1000-8055; Volume 8, no. 4, pp. 345-348; In Chinese; Copyright; Avail: Aeroplus Dispatch

A new algorithm coupled with the variational finite element method (FEM) is presented for solving local flow near the leading or trailing edge of an airfoil or a cascade. The solution consists of two parts. One is an approximate analytical solution of the flow near the stagnation point, it absorbs the changing part in the original solution and makes the rest a more smooth distribution which can be computed more accurately. Taking advantage of the variational principles, it is possible to locate the stagnation point more precisely and automatically. The numerical results show that the method is effective in solving the subsonic flow accurately, especially for nonzero angles of attack. The theory can be coupled with the variational difference method as well as the variational FEM.
Author (revised by AIAA)
Trailing Edges; Leading Edges; Computational Fluid Dynamics; Subsonic Flow

19980022430

Experimental investigation of an end-modified compressor cascade

Wu, Gouhua, Beijing Univ. of Aeronautics and Astronautics, China; Peng, Zeyan, Beijing Univ. of Aeronautics and Astronautics, China; Yan, Ming, Beijing Univ. of Aeronautics and Astronautics, China; Ren, Liyin, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Aerospace Power; Oct. 1993; ISSN 1000-8055; Volume 8, no. 4, pp. 341-344; In Chinese; Copyright; Avail: Aeroplus Dispatch

A compressor end-modified cascade and the original cascade are compared experimentally to study the three-dimensional flow characteristics at the exit plane of the cascade. The results show that the modification of the end part at the trailing edge of the original blade would effectively improve the exit air angle spanwise distribution and meet the need of the inlet air angle of the next row blades, provided that the total pressure loss coefficient does not change or decrease. The test results also indicate that although the camber angle of the blades in the end pan decreases due to the modification, the passage-mass-averaged value of the camber angle changes only slightly. Otherwise, the air flow through the cascade is the same as the original or even better. This technique has been successfully used to improve both the stall margin and efficiency of axial multistage compressors and to depress the unsteady pressure disturbance.
Author (revised by AIAA)
Compressor Blades; Cascade Flow; Three Dimensional Flow; Flow Characteristics; Trailing Edges

19980022431

Prediction of propeller pressure distribution and performance by lifting surface theory

Chen, Zemin, Beijing Univ. of Aeronautics and Astronautics, China; Pan, Jieyuan, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Aerospace Power; Oct. 1993; ISSN 1000-8055; Volume 8, no. 4, pp. 333-336; In Chinese; Copyright; Avail: Aeroplus Dispatch

A numerical method is presented for the prediction of propeller performance and pressure distribution on the blade surface according to the lifting surface theory. The lifting surface model consists of two layers of constant strength quadrilateral vortex-ring elements covering both surfaces of the blades. The velocity jump across the vortex sheet is included in the computation of the pressure distribution. The effect of blade drag is included in the calculation of propeller performance. Numerical results agree well with experimental data for the considered two propellers.

Author (revised by AIAA)

Propeller Efficiency; Pressure Distribution; Performance Prediction; Lifting Bodies

19980022683 NASA Langley Research Center, Hampton, VA USA

Boundary Layer Flow Control with a One Atmosphere Uniform Glow Discharge Surface Plasma

Roth, J. Reece, Tennessee Univ., USA; Sherman, Daniel M., Tennessee Univ., USA; Wilkinson, Stephen P., NASA Langley Research Center, USA; 1998; 29p; In English; 36th; Aerospace Sciences Meeting and Exhibit, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NCC1-223

Report No.(s): NASA/CR-1998-207309; NAS 1.26:207309; AIAA Paper 98-0328; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Low speed wind tunnel data have been acquired for planar panels covered by a uniform, glow-discharge surface plasma in atmospheric pressure air known as the One Atmosphere Uniform Glow Discharge Plasma (OAUGDP). Streamwise and spanwise arrays of flush, plasma-generating surface electrodes have been studied in laminar, transitional, and fully turbulent boundary layer flow. Plasma between symmetric streamwise electrode strips caused large increases in panel drag, whereas asymmetric spanwise electrode configurations produced a significant thrust. Smoke wire flow visualization and mean velocity diagnostics show the primary cause of the phenomena to be a combination of mass transport and vortical structures induced by strong paraelectric ElectroHydroDynamic (EHD) body forces on the flow.

Author

Boundary Layer Flow; Boundary Layer Control; Plasmas (Physics); Wind Tunnel Tests; Data Acquisition; Glow Discharges

19980022684 Fukuyama Univ., Japan

Method for Visualizing Streamlines Around Hypersonic Vehicles by Using Electrical Discharge

Nishio, Masatomi, Fukuyama Univ., Japan; AIAA Journal; Jun. 1992; Volume 30, No. 6, pp. 1662-1663; In English; Copyright; Avail: Issuing Activity (American Inst. of Aeronautics and Astronautics, Inc., The Aerospace Center, 370 L'Enfant Promenade, SW, Washington, DC 20024-2518), Hardcopy, Microfiche

It is very important to obtain shock shapes, pressure distributions, streamlines, etc. around hypersonic vehicles for understanding the characteristics of the flowfield. Recently, a method for visualizing three-dimensional shock shapes around hypersonic vehicles by using an electrical discharge was reported by Nishio. A method for measurement of surface pressure distribution around hypersonic vehicles was reported by Nishio and Kimura. However, it is very difficult to visualize the streamlines because the hypersonic flows obtained by ordinary hypersonic tunnels in laboratories have usually been of considerable low density, high speed, and short duration. The result is that few viable visualizing methods have been reported. Therefore, a useful method for visualizing streamlines of hypersonic flows obtained by ordinary hypersonic tunnels has been required. In this Note, a method for visualizing the streamlines by using an electrical discharge is described.

Author

Hypersonic Vehicles; Hypersonic Flow; Flow Visualization; Laminar Flow

19980022854

Mismatch analysis between compressor stages

Miao, Houwu, Shenyang Aeroengine Research Inst., China; Liu, Jianhua, Shenyang Aeroengine Research Inst., China; Journal of Aerospace Power; Oct. 1993; ISSN 1000-8055; Volume 8, no. 4, pp. 396-398; In Chinese; Copyright; Avail: Aeroplus Dispatch

A new three-stage compressor has been made by scaling up a two-stage transonic compressor and adding a third stage in order to enhance its mass flow and pressure ratio. Tests show that serious flow mismatch exists between the second and third stages. The flow mismatch is attributed to the effect of the scaling-up coefficient on the flow block factor, variation of the rotor blade

airfoil section stagger angles due to centrifugal force, and the unsteady effect for supersonic blading with a low aspect ratio. Owing to the above mentioned three factors, the flow capacity of the third stage is increased by 6.3 percent. Tip-cut of the third stage demonstrates that the flow path area of the third stage is reduced to 93.7 percent, and the modified three-stage compressor has good flow match between the second stage and the third stage; as a result, its surge margin is enhanced by 5.8 percent.
Author (revised by AIAA)
Rotor Blades; Mass Flow; Pressure Ratio; Supersonic Flow; Airfoil Profiles

19980022909
Installed F/A-18 inlet flow calculations at a high angle of attack
Bruns, James E., Sverdrup Technology, Inc., USA; Smith, C. F., Sverdrup Technology, Inc., USA; Journal of Propulsion and Power; Feb. 1994; ISSN 0748-4658; Volume 10, no. 1, pp. 110-115; In English
Contract(s)/Grant(s): NAS3-25266
Report No.(s): AIAA Paper 92-3175; Copyright; Avail: Aeroplus Dispatch
No abstract available.
Angle of Attack; Computational Fluid Dynamics; F-18 Aircraft; Inlet Flow; Navier-Stokes Equation; Yaw

19980022911
Computational investigation of circular-to-rectangular transition ducts
Pao, S. P., NASA Langley Research Center, USA; Carlson, John R., NASA Langley Research Center, USA; Abdol-Hamid, Khaled S., Analytical Services and Materials, Inc., USA; Journal of Propulsion and Power; Feb. 1994; ISSN 0748-4658; Volume 10, no. 1, pp. 95-100; In English
Report No.(s): AIAA Paper 91-3342; Copyright; Avail: Aeroplus Dispatch
No abstract available.
Computational Fluid Dynamics; Duct Geometry; Ducted Flow; Navier-Stokes Equation; Three Dimensional Flow; Transition Flow

19980022930
Numerical studies on flows in a dual-inlet dump combustor
Liao, Changmin, Tsinghua Univ., China; Lin, Wenyi, Tsinghua Univ., China; Zhou, Lixing, Tsinghua Univ., China; Journal of Propulsion Technology; Oct. 1993; ISSN 1001-4055, no. 5, pp. 1-7; In Chinese; Copyright; Avail: Aeroplus Dispatch
The three-dimensional gas flow field in a dual-inlet combustor and the axisymmetrical gas flow field in the inlet tube of this combustor are numerically simulated by using a k-epsilon turbulence model and the SIMPLE algorithm. The sudden expansion ratio of the combustor is 1.1. The predicted results show that there is a slim recirculation zone behind the swirler of the precombustor which is located inside the inlet tube, and the recirculation zone is extended to the primary zone of the combustor. There is a small recirculation zone in the head part of the combustor. It can be concluded that the recirculation zone in the combustor cannot stabilize the flame, and other measures, such as using a precombustor, must be adopted to improve the flame stability.
Author (revised by AIAA)
Dump Combustors; Inlet Flow; Three Dimensional Flow; Computational Fluid Dynamics

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

19980019615 National Transportation Safety Board, Washington, DC USA
National Transportation Safety Board Transportation Safety Recommendations Adopted and Issued during the Month of October 1994
Oct. 1994; 8p; In English
Report No.(s): PB94-916610; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche
This publication contains safety recommendations in the aviation modes of transportation adopted by the National Transportation Safety Board during the month of October, 1994.
NTIS
Air Transportation; Transportation

19980019616 National Transportation Safety Board, Washington, DC USA
National Transportation Safety Board Transportation Safety Recommendations Adopted and Issued during the Month of January 1995
Jan. 1995; 18p; In English
Report No.(s): PB95-916601; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This publication contains safety recommendations in aviation modes of transportation adopted by the National Transportation Safety Board during the month of January, 1995.
NTIS
Transportation; Automated Transit Vehicles

19980019617 National Transportation Safety Board, Washington, DC USA
National Transportation Safety Board Transportation Recommendations Adopted and Issued during the Month of April 1995
Apr. 1995; 7p; In English
Report No.(s): PB95-916604; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This publication contains safety recommendations in aviation modes of transportation adopted by the National Transportation Safety Board during the month of April, 1995.
NTIS
Safety Management; Transportation

19980019618 National Transportation Safety Board, Washington, DC USA
National Transportation Safety Board Transportation Initial Decisions and Orders and Board Opinions and Orders Adopted and Issued during the Month of August 1995
Aug. 1995; 245p; In English
Report No.(s): PB95-916708; NTSB/IDBOO-95/08; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This publication contains all Judge Initial Decisions and Board Opinions and Orders in Safety Enforcement and Seaman Enforcement Cases for August 1995.
NTIS
Safety Management; Transportation

19980019871 Civil Aeromedical Inst., Protection and Survival Lab., Oklahoma City, OK USA
Performance Demonstrations of Zinc Sulfide and Strontium Aluminate Sulfide Photoluminescent Floor Proximity Escape Path Marking Systems ***Final Report***
McLean, Garnet A., Civil Aeromedical Inst., USA; Chittum, Charles B., Civil Aeromedical Inst., USA; Feb. 1998; 12p; In English
Contract(s)/Grant(s): FAA-AM-B-97-PRS-93
Report No.(s): DOT/FAA/AM-98/2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Transport category aircraft are required by 14 CFR 25.812 to have emergency lighting systems, including floor proximity marking systems. Typical floor proximity marking systems installed on transport category aircraft have been primarily comprised of incandescent luminaries spaced at intervals on the floor, or mounted on the seat assemblies, along the aisle. The requirement for electricity to power these systems has made them vulnerable to a variety of problems, including battery and wiring failures, burned-out light bulbs, and physical disruption caused by vibration, passenger traffic, galley cart strikes, and hull breakage in accidents. Attempts to overcome these problems have led to the proposal that non-electric photo-luminescent materials be used in the construction of floor Proximity marking systems. to assess the viability of this proposal, performance demonstrations of systems made with such materials were conducted. It was found that strontium aluminate photoluminescent marking systems can be effective in providing the guidance for egress that floor proximity marking systems are intended to achieve; in contrast, zinc sulfide materials were found to be ineffective.
Author
Performance Tests; Aluminates; Transport Aircraft; Emergencies; Escape Systems

19980020144 Federal Aviation Administration, Washington, DC USA
Notices to Airmen: Domestic/International
Oct. 09, 1997; 218p; In English
Report No.(s): PB98-112758; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Section 1, Airway NOTAMs, is sorted alphabetically by ARTCC and descending FDC NOTAM numerical order. Section 2, Airports/Facilities & Procedural NOTAMs, categories may include Chart Corrections, Airports, Facilities, Procedural NOTAMs, and others as required, and are listed alphabetically by State. Section 3, FDC General NOTAMs, contains NOTAMs that are general in nature and not tied to a specific airport/facility identifier, i.e., flight advisories and restrictions. The International Notices to Airmen feature significant international information and data which may affect a pilot's decision to enter or use areas of foreign or international airspace. Section 4 contains special notices and notices containing graphics pertaining to almost every aspect of aviation, such as military training areas, large scale sporting events that may attract media attention or draw large crowds of aircraft, chart corrections/additions, airshow information, etc.
NTIS
National Airspace System; Charts; Air Navigation; Runways; Constrictions

19980020929 Federal Aviation Administration, Washington, DC USA
Notices to Airmen: Domestic/International, November 6, 1997
Dec. 04, 1997; 196p; In English
Report No.(s): PB98-119464; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

Contents: Airway Notams; Airports, Facilities and Procedural Notams; General EDC Notams; Part 95 Revisions to Minimum En Route IFR Altitudes and Changeover Points; International Notices to Airmen; and Graphic Notices.
NTIS
Air Navigation; Air Traffic Control; Runways; Graphs (Charts); National Airspace System; Airports; Constrictions

19980021248 Advisory Group for Aerospace Research and Development, Aerospace Medical Panel, Neuilly-Sur-Seine, France
The Prevention of Aircraft Accidents Through the Collection and Analysis of Human Factor/Aeromedical Aircraft Accident Data ***La Prevention des Accidents d'Avion par la Collecte et l'Analyse de Donnees d'Accidents Facteurs Humains/Aeromedicaux***
Tejada, F., Editor, Centro de Instruccion de Medicina Aeroespatial, Spain; Magnusson, Kent E., Editor, Air Force Systems Command, USA; Cugley, Jennifer, Editor, Royal Air Force, UK; Courchesne, Cyd E., Editor, Canadian Air Command Headquarters, Canada; Alnaes, A., Editor, Oslo Military Clinic, Norway; Knoefel, H. J., Editor, Institute of Aviation Medicine, Germany; Grau, Jean Yves, Editor, Institut de Medicine Aerospatiale Armee, France; Lyons, Terence J., Editor, Air Force Systems Command, USA; Guadalupi, Francesco, Editor, Commissione Sanitaria di Appello A.M., Italy; Feb. 1998; 124p; In English
Report No.(s): AGARD-AR-361; ISBN 92-836-0052-5; Copyright Waived; Avail: CASI; A06, Hardcopy; A02, Microfiche

The overall goal of Working Group 23 was to improve the application of human factors analysis to operational enhancement and mishap prevention programs. Through different chapters, a variety of related topics were discussed in relation to the current status and approaches to aircraft accident/incident investigation, taking into account the human factors involved, procedures, categorization, tabulation and analysis. In addition, following a questionnaire which was widely distributed among all NATO countries, current data concerning the number of accidents, human factors studies, organizational aspects and the data collection were compiled and discussed. Also the possible approaches to conceptual models were described as a potential framework for the support and organisation of the principles and topics to be included in human factors/aeromedical data base. The Working Group reviewed current training programmes and discussed a common approach, in which human factors play a definite role. Examples of data bases currently in use are enclosed.
Author
Aircraft Accidents; Prevention; Human Factors Engineering; Data Acquisition; Education; Aerospace Medicine

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

19980020225 Minnesota Univ., Minneapolis, MN USA
Analysis of a Differential Global Positioning System as a Sensor for Vehicle Guidance ***Final Report***
Bodor, R., Minnesota Univ., USA; Alexander, L., Minnesota Univ., USA; Liao, C. F., Minnesota Univ., USA; Bajikar, S., Minnesota Univ., USA; Morellas, V., Minnesota Univ., USA; Sep. 1996; 102p; In English
Report No.(s): PB98-115173; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

An ongoing research project examines guidance systems, which can take over control of a vehicle if the driver becomes incapacitated. Part of the project includes an evaluation of a Differential Global Positioning System (DGPS) for vehicle-based lane

sensing. The report documents the results of tests of the 5 Hz NovAtel RT20 DGPS receiver. A series of 32 static tests found the overall mean and standard deviation for the offset errors within specifications.
NTIS
Global Positioning System; Guidance (Motion); Detection

19980020636 Naval Postgraduate School, Monterey, CA USA
Analysis, Experimental Evaluation and Software Upgrade for Attitude Estimation by the Shallow-Water AUV Navigation System (SANS)
Roberts, Ricky L., Naval Postgraduate School, USA; Mar. 1997; 209p; In English
Report No.(s): AD-A331860; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The main problem addressed by this research is the lack of a small, low-cost integrated navigation system to accurately determine the position of an Autonomous Underwater Vehicle (AUV) during all phases of an underwater search or mapping mission. The approach taken utilized an evolving prototype, called the Shallow-Water AUV Navigation System (SANS), combining Global Positioning System (GPS), Inertial Measurement Unit (IMU), water speed, and magnetic heading information using Kalman, low-pass, and complimentary filtering techniques. In previous work, addition of a math coprocessor improved system update rate from 7 to 18 Hz, but revealed input/output coordination weaknesses in the software. The central focus of this thesis is on testing and programming improvements which resulted in reliable integrated operations and an increased processing speed of 40 Hz. This now allows the filter to perform in real time. A standardized tilt table evaluation and calibration procedure for the navigation filter also was developed. The system was evaluated in dynamic tilt table experiments. Test results and qualitative error estimates using differential GPS suggest that submerged navigation with SANS for a period of several minutes will result in position estimation errors typically on the order of 10 meters rms, even in the presence of substantial ocean currents.
DTIC
Shallow Water; Underwater Vehicles; Autonomous Navigation; Real Time Operation; Systems Integration

19980021204 Civil Aeromedical Inst., Oklahoma City, OK USA
Differential Training Needs and Abilities at Air Traffic Control Towers: Should All Controllers Be Trained Equally? *Final Report*
Thompson, Richard C., Civil Aeromedical Inst., USA; Agen, Rebecca A., Civil Aeromedical Inst., USA; Broach, Dana M., Civil Aeromedical Inst., USA; Mar. 1998; 20p; In English
Report No.(s): DOT/FAA/AM-98/8; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The present study uses job elements identified by subject-matter experts to assess the perceived training needs of air traffic control specialists (ATCSs) who are assigned to towers after successful completion of FAA Academy training. The Director of Air Traffic Services tasked The Air Traffic Resource Management Program (ATX) with conducting a training needs assessment. to measure the needed skills and knowledge of new controllers, a survey was developed by ATX and distributed by the Civil Aeromedical Institute to 172 tower level 3, 4, and 5 facility managers and nine regional Air Traffic Division managers. The survey was used to assess the performance-based skills standards needed by new controllers at the time of entry into a field facility. The training capability of individual towers was also examined. The results indicated that there are some differences in the required training of ATCSs assigned to level 4 and 5 towers. Therefore, the tower assignment of new hires should be identified upon entry into the Academy to better focus on the specific training needs of prospective towers.
Author
Air Traffic Control; Air Traffic Controllers (Personnel)

19980021289 European Organization for the Safety of Air Navigation, Experimental Centre, Bretigny-sur-Orge, France
SweDen 1996: Real-Time Simulation, *1996-1997*
Josefsson, B., European Organization for the Safety of Air Navigation, France; Jensen, P. S., European Organization for the Safety of Air Navigation, France; May 1997; 82p; In English
Report No.(s): PB98-114887; EEC-310; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This report describes a real-time simulation study which was conducted on the airspace of Denmark and Sweden. The study assessed the impact of the application of an ODID IV operating interface oriented towards the requirements for Swedish S2000 and Danish Control Centre Copenhagen (CCC) projects.
NTIS
Airspace; Computerized Simulation

19980021291 Naval Postgraduate School, Monterey, CA USA
GPS Signal Phase Tracking Using a Kalman Filter
Newman, Thomas H., Naval Postgraduate School, USA; Jun. 1997; 115p; In English
Report No.(s): AD-A333478; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

One of the more significant error sources in using the Global Positioning System for attitude determination of aircraft and earth orbiting satellites is multipath interference. The GPS signal is reflected from the spacecraft structures resulting in a composite signal that differs from the direct line-of-sight signal in terms of phase and amplitude. The resulting phase errors can have a significant impact on the attitude determination error. This thesis will describe the GPS signal generation and provide tools to simulate the signal. A Kalman filter will then be developed to track the phase changes in the simulated GPS signals, and its performance described in the absence and presence of multipath.
DTIC
Global Positioning System; Kalman Filters; Multipath Transmission; Optimization; Attitude (Inclination); Earth Orbits; Line of Sight

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

19980019876 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Strain Surveys of Fuel Flow Vent Hole Number 13 and Stiffener Runout Number 2 in the F111 Wing Pivot Fitting for a Range of Rework Shapes
Watters, Kevin C., Defence Science and Technology Organisation, Australia; Aug. 1997; 200p; In English; Original contains color illustrations
Report No.(s): DSTO-TR--567; AR-010-305; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

The strain distributions and magnitudes at two locations in the D6ac steel wing pivot fitting (WPF) of the F-111 aircraft have been evaluated by full-scale test of a wing. These locations, known as fuel flow vent hole number 13 and stiffener runout number 2 have been sites of in-service fatigue cracking. The structural features at these two locations produce large stress concentrations and extensive yielding occurs around them under cold proof load testing (CPLT) of the wing (which was simulated in these tests). These locations are subject to in-service reworking to remove detected fatigue cracks, and a range of reworks was simulated in these tests. The interaction of residual stress/strain states (after cyclic plasticity from CPLT loading) and material removal (during reworking) made interpretation of the strain versus load behaviour quite difficult. The difficulty was compounded by an overriding bi-linear elastic structural behaviour of the WPF and complex structural behaviour of the shear web in the WPF. A comprehensive strain versus load data base has been established for these locations to facilitate stress and fatigue analyses.
Author
Strain Distribution; Stress-Strain Relationships; F-111 Aircraft; Wings; Shapes; Cyclic Loads; Load Tests; Stress Concentration; Stress Analysis; Full Scale Tests

19980019878 Defence Science and Technology Organisation, Maritime Platforms Div., Melbourne, Australia
A Microprocessor-Based Gradient Analyser for F/A-18 Bulkhead Spectrum Loading
Sponder, Leopold, Defence Science and Technology Organisation, Australia; Sep. 1997; 37p; In English
Report No.(s): DSTO-TR-0546; AR-010-250; Copyright; Avail: Issuing Activity (DSTO Advanced and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

This report describes a specially designed instrument that was used during a full scale fatigue test of an F/A-18 bulkhead to support the acquisition and analysis of acoustic emission (AE) data for the investigation of crack initiation and growth. This device, developed by the author, comprises both hardware and software and generates binary data in real time that indicates the sign of the gradient of an applied spectrum load signal. This design overcomes the inherent limitations of conventional analog slope detection methods applied to slowly varying aperiodic waveforms.
Author
Bulkheads; F-18 Aircraft; Acoustic Emission; Fatigue Tests; Crack Propagation; Microprocessors; Nondestructive Tests

19980020601 Naval Postgraduate School, Monterey, CA USA

Conventional and Probabilistic Fatigue Life Prediction Methodologies Relevant to the P-3C Aircraft

Kousky, Todd R., Naval Postgraduate School, USA; Mar. 1997; 159p; In English

Report No.(s): AD-A331792; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This thesis investigates conventional and probabilistic methodologies for predicting the fatigue life of critical components in the P-3C aircraft. A probabilistic damage convolution model was developed with the intent of providing quantitative predictions of life-variability. Traditional methodologies, which are based nominally on median values, lack the capacity to adequately assess variability. Aluminum 7075-T6 was tested using a fatigue Material Test System. A fatigue data base was compiled from tests conducted at the Naval Postgraduate School and from literature sources.

DTIC

Fatigue Life; Fatigue Tests; P-3 Aircraft; Prediction Analysis Techniques; Aircraft Equipment

19980020630 Naval Postgraduate School, Monterey, CA USA

Classification Trees and the Analysis of Helicopter Vibration Data

Larson, Harold, Naval Postgraduate School, USA; Sep. 1997; 25p; In English

Report No.(s): AD-A331598; NPS-OR-97-017; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Health and Usage Monitoring Systems are receiving a great deal of interest, in an attempt to increase the safety and operational readiness of helicopters, and to minimize maintenance costs. These systems monitor (and can record) various flight parameters, pilot conversations, engine exhaust debris, metallic chip detector levels in the lubrication system, rotor track and balance, as well as vibration levels at selected locations throughout the airframe and the power drive system. Vibration levels are currently being observed on two operational SH-60B helicopters and on an H-60 power drive system installed in the Helicopter Transmission Test Facility (HTTF) at the Naval Air Warfare Center, Trenton, NJ. This paper employs classification trees to analyse vibration signatures produced in the HTTF, identifying those characteristics which distinguish normal signatures from signatures produced by known faulted parts. These trees are quite successful in separating the two types of signatures and achieve small misclassification rates for HTTF data. They are also applied to vibration data collected from an operational aircraft; assuming the tail gearbox in the operational aircraft has no faults, the trees derived from the HTTF produce a high proportion of false alarms.

DTIC

Aerodynamic Balance; Airframes; Flight Characteristics; H-60 Helicopter; Helicopter Propeller Drive; Helicopters; Lubrication Systems; Rotary Wings; Rotor Aerodynamics; Transmissions (Machine Elements)

19980020847 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Requirements, Design and Prototype of a Virtual User Interface for the AFIT Virtual Spaceplane

Lewis, John M., Air Force Inst. of Tech., USA; Dec. 1997; 157p; In English

Report No.(s): AD-A335063; AFIT/GM/ENP/97D-02; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The USA Air Force is evaluating the feasibility of designing a military spaceplane capable of accomplishing military objectives from a low earth orbit and atmospheric flight regimes. Current efforts are involved in determining the scientific, operational. and budgetary constraints associated with this concept. This thesis looks at the exploration of new interface techniques associated with the design of a virtual spaceplane and is a subset of the overall virtual spaceplane effort which will assist researchers in determining the feasibility of a military spaceplane. Interface techniques are integrated into a virtual user interface that is designed to accommodate expected operations associated with atmospheric and low earth orbit military operations. We expect these operations to include satellite deployment and recovery reconnaissance, and space station construction and resupply. The focus of the virtual user interface design effort involves the application and integration of current interface design methodologies and virtual environment technologies to support the functionality of a virtual spaceplane.

DTIC

Flight Simulators; Virtual Reality; Graphical User Interface

19980020861 Naval Postgraduate School, Monterey, CA USA

Evaluation of the CMARC Panel Code Software Suite for the Development of a UAV Aerodynamic Model

Pollard, Stephen J., Naval Postgraduate School, USA; Jun. 1997; 151p; In English

Report No.(s): AD-A333445; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The CMARC panel code is evaluated to verify its accuracy and suitability for the development of an aerodynamic model of the Naval Postgraduate School (NPS) FROG Unmanned Air Vehicle (UAV). CMARC is a DOS personal computer based version of the NASA Panel Method Ames Research Center (PMARC) panel code. The core processing algorithms in CMARC are equivalent to PMARC. CMARC enhancements include improved memory management and command line functionality. Both panel

codes solve for inviscid, incompressible flow over complex three-dimensional bodies using potential flow theory. Emphasis is first placed on verifying CMARC against the PMARC and NPS Unsteady Potential Flow (UPOT) panel codes. CMARC boundary layer calculations are then compared to experimental data for an inclined prolate spheroid. Finally, a complex three-dimensional panel model is developed for aerodynamic modeling of the FROG UAV. CMARC off-body flow field calculations are used to generate static-source and angle-of-attack vane position corrections. Position corrections are provided in look-up table and curve fit formats. Basic longitudinal and lateral-directional stability derivatives are also developed with CMARC data. CMARC derived stability derivatives are sufficiently accurate for incorporation into an initial aerodynamic model. Adjustments through analysis of flight test data may be required. Future CMARC studies should concentrate on the development of the damping and control power derivatives.
DTIC
Panel Method (Fluid Dynamics); Pilotless Aircraft; Inviscid Flow; Incompressible Flow; Three Dimensional Models; Flow Distribution; Computational Fluid Dynamics

19980020944 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Architecture, Design, and Implementation of a Rapidly Prototyped Virtual Environment for a Military Spaceplane
Rothermel, Scott A., Air Force Inst. of Tech., USA; Dec. 1997; 141p; In English
Report No.(s): AD-A334904; AFIT-GCS-ENG-97D-17; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The new Global Engagement vision places increased emphasis on the Air Force's ability to control and exploit space. A military spaceplane combining reliable access to space, high operational tempos, and multi-mission capabilities is in conceptual stages of development. Virtual environment technology provides an opportunity to investigate system requirements and unconventional interface paradigms for this unique vehicle. A virtual environment architecture and design based on support for a rapid prototyping development process, separation of concerns, and user interface development is presented. The rapid prototyping process allowed management of changing requirements via an evolutionary approach to implementation. Separation of the activities performed by the virtual environment into classes enabled high performance through computational distribution, prevented modifications from rippling through the system and impeding development, and promoted reuse of computation and geometric models. A technique was developed to reduce the flimmer induced by the large spatial extent of the virtual environment. The architecture succeeded in providing a flexible framework for the AFIT Virtual Spaceplane. The Virtual Spaceplane is a large scale virtual environment within which an immersed user commands a military spaceplane through atmospheric and orbital regimes to complete several simulated missions via an unconventional virtual interface.
DTIC
Aerospace Planes; Computation; Prototypes; Flight Simulation; Virtual Reality

19980020965 Dayton Univ., Dept. of Engineering, OH USA
Predicting Reliability and Maintainability Factors for Aircraft Subsystems During the Conceptual Phase of Aircraft Decision ***Final Report, Jan. - Aug. 1997***
Hatzis, Anthony S., Dayton Univ., USA; Aug. 1997; 160p; In English
Report No.(s): AD-A335103; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

In the past thirty years, reliability and maintainability have become a growing part of system design. This is due in part to the knowledge imparted by the problems incurred on the first generation of complex jet aircraft. Many lessons were learned from the first generation aircraft that are now incorporated in modern aircraft design. Today's environment of budget cuts and constraints also requires reliability to be built into an aircraft design in the conceptual stage of design. For space systems, it is imperative that reliability be built into the design in the very early stages and considered throughout the design process. This case study used aircraft design and performance characteristics (independent variables) and reliability and maintainability parameters (dependent variables) in multiple regression analysis to develop parametric equations that predict reliability and maintainability factors for aircraft subsystems. The subsystems analyzed were landing gear and engines.
DTIC
Aerospace Systems; Aircraft Structures; Jet Aircraft; Maintainability; Reliability; Systems Engineering; Aircraft Design

19980021259 National Aerospace Lab., Centre for Civil Aircraft Design and Development, Bangalore, India
Centre for Civil Aircraft Design and Development ***Annual Report, 1996 - 1997***
Jul. 1997; 52p; In English
Contract(s)/Grant(s): NAL Proj. ID-8-117
Report No.(s): NAL-SP-9714; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Centre for Civil Aircraft Design and Development (C-CADD) coordinates and manages the activities related to HANSA, the ab-initio all composite trainer and SARAS, the 14 seat turboprop light transport aircraft. During the year 1996-97, significant progress has been achieved in both the projects. The first prototype of HANSA-3 was flown on 25th November 1996. The groups that involved in this project include Flight Experiments Division, Computational and Theoretical Fluid Dynamics Division, Structural Sciences Division, FRP Pilot Plant, Structural Integrity Division, Engineering Services Division and the Wind Energy Workshop. The project team worked hard to complete the activities of design, fabrication and integration by the end of October ’96 well on time to make the aircraft participate in Aero-India 1996 (soon after its maiden flight). Detail design activities of SARAS are in full swing and this phase is expected to be completed by the end of 1997. The configuration design of SARAS was reviewed by an Expert Committee. Design drawings and layouts of the aircraft’s components are made on Computer Aided Three dimensional Interactive Application (CATIA), available in the Raj Mahindra CAD Facility in C-CADD. to meet the schedule for this phase, additional facilities have been built in the CAD Facility. Further wind tunnel tests on SARAS are planned in TsAGI and IISc wind tunnels and fabrication of wind tunnel models is nearing completion. Tests on ’combined’ air intake are in progress. Details of these activities are reported in the following sections.
Author
Industrial Plants; Military Air Facilities; Logistics Management; Terminal Facilities; Research Facilities

19980021287 PKCR, Inc., Seattle, WA USA
Mechanical Design of High Lift Systems for High Aspect Ratio Swept Wings
Rudolph, Peter K. C., PKCR, Inc., USA; Feb. 1998; 118p; In English
Contract(s)/Grant(s): NASA Order A-49736-D
Report No.(s): NASA/CR-1998-196709; A-989497; NAS 1.26:196709; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The NASA Ames Research Center is working to develop a methodology for the optimization and design of the high lift system for future subsonic airliners with the involvement of two partners. Aerodynamic analysis methods for two dimensional and three dimensional wing performance with flaps and slats deployed are being developed through a grant with the aeronautical department of the University of California Davis, and a flap and slat mechanism design procedure is being developed through a contract with PKCR, Inc., of Seattle, WA. This report documents the work that has been completed in the contract with PKCR on mechanism design. Flap mechanism designs have been completed for seven (7) different mechanisms with a total of twelve (12) different layouts all for a common single slotted flap configuration. The seven mechanisms are as follows: Simple Hinge, Upside Down/Upright Four Bar Linkage (two layouts), Upside Down Four Bar Linkages (three versions), Airbus A330/340 Link/Track Mechanism, Airbus A320 Link/Track Mechanism (two layouts), Boeing Link/Track Mechanism (two layouts), and Boeing 767 Hinged Beam Four Bar Linkage. In addition, a single layout has been made to investigate the growth potential from a single slotted flap to a vane/main double slotted flap using the Boeing Link/Track Mechanism. All layouts show Fowler motion and gap progression of the flap from stowed to a fully deployed position, and evaluations based on spanwise continuity, fairing size and number, complexity, reliability and maintainability and weight as well as Fowler motion and gap progression are presented. For slat design, the options have been limited to mechanisms for a shallow leading edge slat. Three (3) different layouts are presented for maximum slat angles of 20 deg, 15 deg and 1O deg all mechanized with a rack and pinion drive similar to that on the Boeing 757 airplane. Based on the work of Ljungstroem in Sweden, this type of slat design appears to shift the lift curve so that higher lift is achieved with the deployed slat with no increase in angle of attack. The layouts demonstrate that these slat systems can be designed with no need for slave links, and an experimental test program is outlined to experimentally validate the lift characteristics of the shallow slat.
Author
Design Analysis; Aerodynamic Characteristics; Lift; European Airbus; Boeing 757 Aircraft; Angle of Attack

19980021472
Vibroacoustic analysis of trimmed aircraft through modal and principal field modelling
Van den Auweraer, H., LMS International, Belgium; Otte, D., LMS International, Belgium; Augusztinovicz, F., Leuven, Katholieke Univ., Belgium; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4380; Copyright; Avail: Aeroplus Dispatch

In the ’principal-field analysis’ method presently employed for effective aircraft interior noise-reduction measures, a singular value decomposition of the multireference frequency-response function matrix can be performed at each frequency. by plotting the singular values as functions of frequencies, it becomes possible to obtain a global view of the dominant frequencies and the

number of dominant modes at each frequency. Acoustic behavior of interior noise aboard four different aircraft is found to be dominated by longitudinal phenomena.
AIAA
Aircraft Noise; Noise Reduction; Structural Vibration; Resonant Frequencies; Active Control

19980021473
Computational modeling considerations for aircraft cockpit noise
Engelstad, S. P., Lockheed Aeronautical Systems Co., USA; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4378; Copyright; Avail: Aeroplus Dispatch

The paper describes the application of the FEM and statistical energy analysis (SEA) technique to the prediction of interior noise in an aircraft cockpit. The physical problem involved the resonant noise transmission of the aircraft canopy into the cockpit air space. The primary excitation of the canopy was the external turbulent flow. Laboratory noise transmission and structural natural modes tests were performed on the aircraft canopy to validate the numerical models. Analytical investigations were performed to determine important modeling considerations. In the FEM analysis, various excitation models were used to simulate the near-field fluctuating pressures of the turbulent boundary layer that excited the canopy in flight. FEM results compared best to the flight test data when the random excitation was used. In the SEA analysis, the excitations included a reverberant field for the lab test and a random turbulent boundary layer for flight. The predictions compared well for both flight test and lab test results.
Author (AIAA)
Cockpits; Noise Prediction; Sound Transmission; Resonant Frequencies; Modes (Standing Waves)

19980021854
Aircraft interior noise control by anisotropic trim panel
Amano, Kanichi, Japan Aircraft Development Corp., Tokyo, Japan; Okura, Kiyoshi, Mitsubishi Heavy Industries, Ltd., Japan; Izumiyama, Kazuo, Mitsubishi Heavy Industries, Ltd., Japan; Shibata, Katsuhiko, Mitsubishi Heavy Industries, Ltd., Japan; Matsuzaki, Katsuya, Mitsubishi Heavy Industries, Ltd., Japan; Yesil, Oktay, Boeing Commercial Airplane Group, USA; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4379; Copyright; Avail: Aeroplus Dispatch

For a typical transport aircraft, the fuselage shell's ring frequency is in the 200-500 Hz range; several important sources of noise also lie within this range. An anisotropic trim panel is here used to improve the sound transmission loss (TL) characteristics of such an aircraft's sidewall, which are degraded at frequencies near the ring frequency. A trim panel with the lower ring frequency is used to recover the TL over the 200-500 Hz frequency range.
AIAA
Aircraft Noise; Sound Transmission; Control Systems Design; Noise Measurement

19980022374
MD-80 active noise control flight demonstration
Finck, R., McDonnell Douglas Corp., USA; Lang, M., McDonnell Douglas Corp., USA; May, D., McDonnell Douglas Corp., USA; Simpson, M., McDonnell Douglas Corp., USA; Paxton, M., NCT Cabin Systems, UK; Purver, M., NCT Cabin Systems, UK; Ross, C., NCT Cabin Systems, UK; Baptist, M., Dowty Maritime, UK; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4439; Copyright; Avail: Aeroplus Dispatch

This paper describes a flight test program conducted to demonstrate the effectiveness of active noise control techniques in reducing tone noise levels in the aft cabin of the MD-80 aircraft. The active noise control system used for the flight demonstration utilized loudspeakers attached to the cabin trim to generate the control sounds and microphones in the trim and seat backs to measure the residual noise. The control system used an interface with the engine rpm signals to obtain reference signals from each engine spool. The active noise control system was installed in the aft cabin area of a furnished production MD-80 aircraft. The MD-80 was then operated through a typical profile consisting of ground taxi, takeoff, climb, two cruise conditions, and descent. For each operating condition the control system was cycled on and off several times, and noise levels were monitored during each cycle at typical aft cabin passenger locations. The system operated as expected, producing substantial tone noise reductions for each ground and flight condition.
Author (AIAA)
Aircraft Compartments; Noise Reduction; Active Control; Flight Tests; Sound-Sound Interactions

19980022448 Department of the Navy, Washington, DC USA

Pencil Drain Fixture for Aircraft Defueling

Hannick, Sidney L., Inventor, Department of the Navy, USA; Sep. 15, 1997; 13p; In English

Patent Info.: Navy-Case-77011; US-Patent-Appl-SN-929977

Report No.(s): AD-A334629; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A pencil drain fuel fixture for defueling aircraft pencil drains is provided. The pencil drain fixture has an extendable strut with a non-slip rubber base. The strut is set up on the tarmac under an aircraft pencil drain and extended to engage the drain. The upper end of the strut contains a funnel and pencil drain release rod mechanism which opens the pencil drain and by funnel and drain tube directs the fuel to a catch basin.

DTIC

Aircraft Maintenance; Fuel Cells; Aircraft Engines

19980022482

Cabin noise cancellation using active rpm control OV-10A flight test results

Pla, Frederic G., GE Corporate Research and Development Center, USA; Goodman, George, GE Corporate Research and Development Center, USA; Ranaudo, Richard, NASA Lewis Research Center, USA; Silcox, Richard, NASA Langley Research Center, USA; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4438; Copyright; Avail: Aeroplus Dispatch

Results are presented on active noise reduction inside the cabin of an OV-10A aircraft using a microphone-driven active RPM controller. The noise inside the cabin of a multiengine turboprop or turbofan aircraft can be minimized if the proper phase relationships are maintained between propellers or engines. A microphone-driven active RPM controller constantly maintains the proper phase relationship between engines which results in minimum cabin noise levels, regardless of the varying conditions which might affect cabin acoustics. Test results show that cabin noise is reduced by ns much as 9 dB overall and 15 dB at the blade passage frequency at the passenger location. Noise cancellation is more limited in the air section away from the propeller plane where beat amplitude is low. The controller works very well at all RPMs tested and stays locked through steady and transient maneuvers well beyond what is encountered in normal commercial flight operations.

Author (revised by AIAA)

Active Control; Aircraft Compartments; Noise Reduction; Flight Tests; Sound-Sound Interactions

19980022483

Aircraft cabin noise reduction tests using active structural acoustic control

Mathur, Gopal P., McDonnell Douglas Corp., USA; Tran, Boi N., McDonnell Douglas Corp., USA; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4437; Copyright; Avail: Aeroplus Dispatch

Results of experimental investigations of active structural acoustic control (ASAC) of cabin noise in a full scale DC-9 aircraft fuselage are presented. The airborne excitation was simulated by an exterior speaker and the structure-borne excitation was simulated by a shaker. The active control of cabin sound field was achieved by several piezoceramic actuators bonded to the fuselage. Significant sound pressure reductions were measured throughout the cabin for all eight frequencies of excitation. The ASAC tests showed that there is a possibility of generating spillover vibration and noise. The performance of the ASAC method is also compared with that of a speaker based active noise control system.

Author (AIAA)

Aircraft Compartments; Noise Reduction; Active Control; Acoustic Attenuation; Acoustic Excitation

19980022484

Aircraft cabin active noise control performance sensitivity tests

Simpson, Myles A., McDonnell Douglas Corp., USA; Tran, Boi N., McDonnell Douglas Corp., USA; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4436; Copyright; Avail: Aeroplus Dispatch

Test program results are presented for a prototype active cabin-noise control system in which loudspeakers are mounted in the cabin as control sources, and microphones on seat backs and aisles are used as error sensors. The tests were conducted aboard a DC-9 aft cabin section at a ground test facility. Significant global control was achieved for all excitations, with the greatest reductions being achieved in the aft cabin and for lower-frequency tones.

AIAA

Active Control; Acoustic Attenuation; Aircraft Compartments; Aircraft Noise; Noise Reduction

19980022515

Dynamic analysis of bearingless rotor blades based on nonlinear shell models with drilling degree-of-freedom

Bauchau, Olivier A., Rensselaer Polytechnic Inst., USA; Chiang, Wuying, Rensselaer Polytechnic Inst., USA; 1992, pp. 25-39; In English; Copyright; Avail: Aeroplus Dispatch

The unique structural features of bearingless rotors calls for the development of design and modeling methodologies for laminated composite flex-structures. Indeed, the flex-structure should be flexible enough to replace the flap, lead-lag, and leathering bearings, while maintaining high strength and stiffness in the axial direction. Laminated composite materials are a material of choice for such an application. Chordwise deformations, transitional zones between different cross sections and localized compressive stresses are all likely to be present in the flex-structure, rendering the validity of a beam model questionable. In this paper a nonlinear anisotropic shallow shell model is developed that accommodates transverse shearing deformations, and arbitrarily large displacements and rotations, but strains are assumed to remain small. The displacement-based shell model has six DOFs at each node and allows for an automatic compatibility of the shell and beam models. The model is validated by comparing its predictions with several benchmark problems. A four-bladed composite bearingless tail rotor system is analyzed in detail using the shell model and compared with the predictions of a beam model. Drastic differences are observed between the two models, specially in the torsional behavior.

Author (AIAA)

Rigid Rotors; Rotor Blades; Dynamic Structural Analysis; Helicopter Design; Elastic Shells; Bending Moments

06
AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

19980020423

ESD in the sky: Keeping static grounded

Abrams, Stan, Compliance Engineering; Compliance Engineering; September-October, 1997; ISSN 0898-3577; Volume 14, no. 5; 5p; In English; Copyright; Avail: Issuing Activity

The Federal Aviation Administration (FAA) and the National Transportation and Safety Board (NTSB), despite having conflicts, are focused on a fundamental approach towards the reduction of fuel tank explosions. Sources such as static electricity are extremely difficult to control and to date, safety measures have not been completely effective despite FAA’s safety measures. These sources of static electricity include triboelectrification, engine exhaust ionization, precipitation charging, and close proximity to a thunderstorm. Whether the NTSB’s recommendations are the solution or better state control is the answer, the FAA decision will most likely bring static discharge issues to the discourse of popular opinion.

EI

Aircraft Fuels; Fuel Tanks; Electric Discharges; Accident Prevention; Safety Factors; Explosions

19980020638 Army Command and General Staff Coll., Fort Leavenworth, KS USA

Nonmilitary Specification Procurements in Department of Defense Aviation Avionics Acquisition Programs

Wood, Bradley J., Army Command and General Staff Coll., USA; Jun. 07, 1997; 90p; In English

Report No.(s): AD-A331798; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This study investigates the barriers to adopting commercial products relating to aircraft avionics with the Department of Defense after the passage of the Federal Acquisition Streamlining Act (FASA) of 1994. There has been a strong emphasis from both the federal government and industry for the Department of Defense to adopt commercial products and practices. The focus of this study is to identify the barriers that exist to accomplish this goal, in the aircraft related avionics systems market, after the passage of FASA. This study concludes that the barriers to procuring NON-MILSPEC aviation avionics in the DOD, after FASA, fall into three general categories: specifications, logistics, and management training. Research also supports the conclusion that while FASA may eliminate some logistics barriers, it will not likely effect barriers related to specifications, or management, and training.

DTIC

Avionics; Commercial Aircraft; Procurement

19980020786

Evaluation of tungsten carbide thermal spray coatings as replacements for electrodeposited chrome plating on aircraft landing gear

Bodger, B. E.; McGrann, R. T. R.; Somerville, D. A.; Plating and Surface Finishing; September, 1997; ISSN 0360-3164; Volume 84, no. 9, pp. 28-31; In English; Copyright; Avail: Issuing Activity

Tungsten carbide (WC) thermal spray coatings applied by the high velocity oxy-fuel (HVOF) process are considered the leading candidates for replacement of hard chrome plating. This article describes the decision-making process followed to establish the acceptability of WC thermal spray coatings for aircraft landing gear applications. Descriptions of both the laboratory testing phase and the in-service evaluation phase are given.

Author (EI)

Aircraft Landing; Landing Gear; Tungsten Carbides; Sprayed Coatings; Decision Making

19980022858

An expert system for aeroengine oil monitoring

Zhong, Rongbin, Beijing Univ. of Aeronautics and Astronautics, China; Ma, Mei, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Aerospace Power; Oct. 1993; ISSN 1000-8055; Volume 8, no. 4, pp. 375-378; In Chinese; Copyright; Avail: Aeroplus Dispatch

Since oil monitoring is an effective diagnostic method in aeroengine troubleshooting, an expert system, OSTM (Oil System Troubleshooting Master), is developed. Its goal is to help maintenance personnel to analyze the complex information acquired from oil monitoring. The software is implemented in Turbo Prolog and customized for use in portable personal computers. An exhaustive back-chain inference algorithm is adopted. A menu query interface is programmed for quick manipulation of particular faults. For this purpose, the fault symptoms are classified according to their respective diagnostic domains. Moreover, knowledge acquisition and knowledge base management modules have been created.

Author (revised by AIAA)

Aircraft Engines; Engine Control; Expert Systems; Fuel Oils; Engine Monitoring Instruments

19980022949

An investigation for temperature sensor applied in exhaust jet of small turbojet engines and in amplifier of signal

Chen, Dinfang, 31st Research Inst., China; Journal of Propulsion Technology; Oct. 1993; ISSN 1001-4055, no. 5, pp. 72-74, 16; In Chinese; Copyright; Avail: Aeroplus Dispatch

The temperature sensor is made of high temperature alloy GH30 and has a grounded metal-sheathed thermocouple (MST) 1.5 mm in diameter as its temperature measuring element. The upper temperature limit of this kind of MST is 900 C for short-time use and 800 C for long-time use. Its time constant is less than 0.3 s, and it operates reliably in an engine under vibration and hot aerodynamical conditions. Its signal amplifier is of the differential input type and available for the output signal of grounded thermocouples. The amplifier also has good noise immunity, compact structure, and good electrical performance.

Author (revised by AIAA)

Turbojet Engines; Temperature Sensors; High Temperature Environments; Vibration Effects; Jet Exhaust

07
AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

19980019574 Garrett Turbine Engine Co., Phoenix, AZ USA

Simulated Bladed MMC Disk LCF Validation *Final Report*

Merrick, H. F., Garrett Turbine Engine Co., USA; Costen, M., Aerospace Structural Research Corp., USA; Feb. 1998; 77p; In English

Contract(s)/Grant(s): NAS3-27564

Report No.(s): NASA/CR-1998-207063; NAS 1.26:207063; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The goal of this program was to evaluate the low cycle fatigue behavior of an SCS-6/Ti-6Al-4V sub-component under bi-axial loading conditions at 316 C(600 F). A simulated bladed TMC disk was designed having thirty four blades representing the number that would be used in Allied Signal's JTAGG II impeller. The outer diameter of the bladed ring was 254 mm (10.0 inch) and the inner diameter 114.3 mm (4.50 inch). The outer and inner diameter of the composite zone was 177.8 mm (7.00 inch) and 127.O

mm(5.00 inch) respectively. Stress analysis showed that the fatigue life of the bladed composite ring would be about 12000 cycles for the test conditions applied. A modal analysis was conducted which showed that the blades would have sufficient life margin from dynamic excitation. The arbor design was the same as that employed in the spin-to burst test of NAS3-27027. A systematic stress analysis of each part making up the arbor was undertaken to assure the design would meet the low cycle fatigue requirements of the program. The Textron Systems grooved foil-fiber process was chosen to make the SCS-6/Ti-6Al-4V core ring based on the success they had in contract NAS3-27027. Fiber buckling, however, was observed at several locations in the first ring made which rendered it unsuitable for spin testing. The fiber buckling was attributed to cracking of the graphite tooling during the consolidation process. On this basis a second ring was made but it too contained fiber buckling defects. Analysis by Textron indicated that the fiber buckling was most likely due to poor placement of the SCS-6 fiber in the etched grooves of the Ti-6Al-4V foil. This was also a contributor to the defects in the first ring. Since there was little indication of control in the process to manufacture a quality ring a third attempt at making a ring was not undertaken.
Author
Design Analysis; Fatigue Life; Stress Analysis; Titanium Alloys; Vanadium Alloys; Aluminum Alloys; Excitation; Spin Tests; Proving

19980020655 Academy of Sciences of the Ukraine, Kiev, Ukraine
Flow Control Around Turbine Blades Using the Centrifugal Instability Analysis ***Final Report***
Yurchenko, Nina, Academy of Sciences of the Ukraine, Ukraine; Aug. 1997; 7p; In English
Contract(s)/Grant(s): F61708-97-W-0229
Report No.(s): AD-A332554; EOARD-97-4069; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report results from a contract tasking Institute of Hydromechanics, National AS as follows: The contractor will perform experimental investigation of a large scale vortical structure in boundary layers over turbine blades. The research is to be performed at the Propulsion Directorate of Wright laboratory in Dayton, OH.
DTIC
Boundary Layers; Centrifugal Force; Turbine Blades

19980021476
Recent developments in turbomachinery noise control and reduction systems
Julliard, J., SNECMA, France; Riou, G., SNECMA, France; Lozachmeur, C., SNECMA, France; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4375; Copyright; Avail: Aeroplus Dispatch

The shorter engine inlet, lower blade numbers, and lower fan tip speeds that are anticipated in next-generation turbofans for commercial airliners prompt the present consideration of improvements to turbofan nacelle noise-reduction liners. Attention is given to liner sizing methods as well as to emerging opportunities for directly affecting noise-source characteristics, noise propagation, and noise radiation characteristics of a turbomechanical system.
AIAA
Turbomachinery; Noise Reduction; Turbofans; Engine Inlets; Linings

19980021859
Supersonic jet noise reduction by tabs and ejectors
Ahuja, K. K., Georgia Inst. of Technology, Atlanta, USA; Oct. 1993; In English
Contract(s)/Grant(s): NAG3-1066
Report No.(s): AIAA Paper 93-4347; Copyright; Avail: Aeroplus Dispatch

An experimental investigation is conducted of the effect of vortex-generating mechanical tabs, which protrude normally into the flow of a nozzle, on the mixing and noise emission characteristics of the jet at jet Mach numbers in the 0.8-1.4 range. Attention is given to the effect of two diametrically opposed tabs for three nozzle diameters. The test configurations are nozzle alone, nozzle and two tabs, nozzle and ejector, and nozzle with both tabs and ejector.
AIAA
Jet Aircraft Noise; Supersonic Jet Flow; Noise Reduction; Ejectors; Tabs (Control Surfaces)

19980022085
Combustion oscillations in a twin-stream afterburner
Macquisten, M. A., Rolls-Royce, PLC, Combustion Dept., UK; Dowling, A. P., Cambridge Univ., UK; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4392; Copyright; Avail: Aeroplus Dispatch

In a modern turbo-fan engine, the afterburner flameholders are positioned in the mixing flow between the core and bypass streams. These two streams have different velocities and temperatures. They also have different duct lengths and, therefore, different acoustic properties. The influence of such a twin-stream supply on acoustically-coupled combustion oscillations is investigated in this paper. Measurements on an experimental rig show how differences in the acoustic impedances, the mean velocities and the mean temperatures in the two supply streams lead to appreciably different unsteady heat release rates in the two streams. These affect the frequency of the combustion oscillation. A theory explains these results and correctly describes the variation in frequency as the properties of the two supply streams are varied.
Author (AIAA)
Turbofan Engines; Combustion Stability; Turbulent Mixing; Sound Waves; Pressure Oscillations

19980022102

In-flight acoustic mode measurements in the turbofan engine inlet of Fokker 100 aircraft

Sarin, S. L., Fokker Aircraft, Netherlands; Rademaker, E. R., National Aerospace Lab., Netherlands; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4414; Copyright; Avail: Aeroplus Dispatch

A knowledge of the modal content prevailing in an engine inlet is of utmost importance for designing the optimum acoustic treatment. This paper describes results of inflight measurements of circumferential modes as carried out in the untreated and treated inlet of a Fokker 100 aircraft. In order to determine the modes, the inlet was instrumented with a large number of microphones and accelerometers. In addition static pressures in the vicinity of each microphone were measured. It is found that for the untreated inlet the modal energy at 1 BPF is concentrated in a few scattered modes, the modes being adjacent to the mode of the rotor with 22 blades. For treated inlet broadband modal spectra are found which cannot be directly related to the Tyler and Sofrin rule.
Author (revised by AIAA)
Turbofan Engines; Engine Inlets; Sound Fields; Noise Reduction

19980022107

Effects of tab size on supersonic underexpanded cold and heated jet noise suppression and jet thrust loss

Kobayashi, H., National Aerospace Lab., Japan; Oinuma, H., National Aerospace Lab., Japan; Sawamura, T., Waseda Univ., Japan; Outa, E., Waseda Univ., Japan; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4348; Copyright; Avail: Aeroplus Dispatch

An experimental investigation is conducted of the effects of tab size on noise suppression and thrust loss characteristics of both underexpanded cold and heated jets. Sixteen different height/width rectangular tab shapes are tested. In cold jet cases, the smallest size tab produced the same noise level reduction as larger ones, and eliminated screech tones. In heated jet cases, the tabs efficiently eliminated screech tones as well as reduced broadband shock-associated noise.
AIAA
Jet Aircraft Noise; Supersonic Jet Flow; Noise Reduction; Jet Thrust; Tabs (Control Surfaces)

19980022108

Fluid-acoustic interactions in a low area ratio supersonic jet ejector

Krothapalli, Anjaneyulu, Florida Agricultural and Mechanical Univ.; Florida State Univ., Tallahassee, USA; Ross, Christopher, Florida Agricultural and Mechanical Univ.; Florida State Univ., Tallahassee; Yamomoto, K., McDonnell Douglas Aerospace, USA; Joshi, M. C., McDonnell Douglas Aerospace, USA; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4346; Copyright; Avail: Aeroplus Dispatch

An experimental investigation was carried out to determine aerodynamic and acoustic characteristics of a low area ratio rectangular jet ejector. A supersonic primary jet issuing from a rectangular convergent-divergent nozzle of aspect ratio four, into a rectangular duct of area ratio three was used for this study. Improved performance was found when the ejector screech tone is most intense and appears to match the most unstable Strouhal number of the free rectangular jet. When the primary jet was operating at over and ideally expanded conditions, significant noise reduction was obtained with the ejector as compared to a corresponding free jet. Application of particle image velocimetry to high speed ejector flows was demonstrated through the measurement of instantaneous 2D velocity fields.
Author (revised by AIAA)
Jet Aircraft Noise; Supersonic Jet Flow; Acoustic Propagation; Fluid Flow; Noise Reduction

19980022109

Thrust characteristics of a supersonic mixer ejector

Tillman, T. G., United Technologies Research Center, USA; Presz, W. M., Jr., Western New England College, USA; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4345; Copyright; Avail: Aeroplus Dispatch

Experimental data and analytical results are presented for a supersonic mixing ejector lobed-nozzle design, which is intended to reduce acoustic emissions while mixing the high velocity exhaust of a high speed civil transport engine nozzle with the freestream. The thrust data analyzed show that such a mixer-ejector exhibits invariant trust gains over a range of pressure ratios which choke this lobed nozzle configuration. Performance comparisons are made with a conventional slot-nozzle ejector, showing the superiority of the present design.

AIAA

Supersonic Transports; Supersonic Jet Flow; Ejectors; Thrust Augmentation

19980022115

Active noise control of a jet engine at low frequency radiation - B.E.M. for predicting far-field noise reduction

Berge, D., SNECMA, France; Bouty, E., SNECMA, France; Cailleau, J. M., SNECMA, France; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4354; Copyright; Avail: Aeroplus Dispatch

The growing interest in ultrahigh-bypass ratio turbofan engine concepts has prompted greater attention to LF noise radiation in overflight noise signatures, which current 'passive' noise-reduction solutions are comparatively ineffective. An effort is presently made to control the directivity of engine LF radiation away from cabins and overflown areas, using a simulation technique for active noise control. The RAYON-AXI computer code is employed in these simulations.

AIAA

Active Control; Aircraft Engines; Noise Reduction; Sound Fields; Engine Design

19980022116

Theoretical implications of Active Noise Control for turbofan engines

Kraft, Robert E., GE Aircraft Engines, USA; Kontos, Karen B., GE Aircraft Engines, USA; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4355; Copyright; Avail: Aeroplus Dispatch

The objective of this study is to develop the analytical tools that will allow the assessment of the feasibility of using Active Noise Control (ANC) in aircraft engine ducts to suppress radiated tones. It is assumed that the active noise control system will operate using the 'noise cancellation' principle, such that control sound source transducers will inject sound into the duct that directly interferes with the sound generated by the turbomachinery sources. The approach will be to develop the theory needed based on duct modal analysis. In addition, it is hoped that an analytical approach for assessing the feasibility of aircraft engine ANC systems may also provide some guidance for the design optimization of such systems. Analyses are developed for the circumferential and radial mode coupling of wall-mounted sources to a cylindrical duct. A sample case is included that examines energy requirements for ANC source generation.

Author (AIAA)

Active Control; Turbofan Engines; Ducts; Noise Reduction; Sound-Sound Interactions

19980022393

Effect of surface finish on turbine airfoil cascade losses

Radmard, Rama, Carleton Univ., Canada; Turyk, Peter J., Pratt & Whitney Canada, Mississauga; Carscallen, William E., National Research Council of Canada, Ottawa; Canadian Aeronautics and Space Journal; Sep. 1993; ISSN 0008-2821; Volume 39, no. 3, pp. 157-165; In English; Copyright; Avail: Aeroplus Dispatch

A collaborative research program between Pratt and Whitney Canada and the National Research Council Canada is briefly described. During a test program on a planar transonic turbine cascade to determine the effects of maximum thickness to chord ratio on total pressure losses, the test airfoil surfaces were refinished to remove manufacturing defects. The refinished airfoils exhibited a reduction in total losses between 6 and 18 percent. The loss reduction is attributed to the removal of flat spots, which caused what appeared to be, from surface flow visualization, separation bubbles on the airfoil surfaces.

Author (revised by AIAA)

Aircraft Engines; Airfoil Profiles; Surface Finishing; Turbine Blades; Thickness Ratio

19980022427

A bifurcation phenomenon in combustor with non-slat conical swirler

Jiao, Shujian, Tsinghua Univ., China; Lee, Jin, Tsinghua Univ., China; Liu, Jing, Tsinghua Univ., China; Chen, Liru, Tsinghua Univ., China; Journal of Aerospace Power; Oct. 1993; ISSN 1000-8055; Volume 8, no. 4, pp. 353-357; In Chinese; Copyright; Avail: Aeroplus Dispatch

A bifurcation phenomenon was discovered experimentally in a gas turbine combustor with a nonslat conical swirler. With different kinds of perturbation, two different flow patterns may be found in the liner of this gas turbine combustor. The characteristics of these two flow patterns are described in detail. In addition, a brief analysis of the causes of this phenomenon is made, and it is shown that this phenomenon causes periodical flame fluctuations.

Author (revised by AIAA)

Aircraft Engines; Combustion Chambers; Swirling; Conical Flow; Branching (Mathematics)

19980022433

Experimental study of engine performance and internal flow field under inlet distortion

Li, Wenlan, Northwestern Polytechnical Univ., China; Huang, Zhitao, Northwestern Polytechnical Univ., China; Hu, Zhengfeng, Northwestern Polytechnical Univ., China; Journal of Aerospace Power; Oct. 1993; ISSN 1000-8055; Volume 8, no. 4, pp. 323-327; In Chinese; Copyright; Avail: Aeroplus Dispatch

A turbojet engine has been tested under conditions of screen-induced inflow distortion. Its compressor interstage flow field (static pressure, total pressure, and total temperature), inlet distortion transmission, temperature field at the turbine outlet, and bed-tested engine performance were measured. The measurements indicate that: the inlet total and static pressure distortions are attenuated through the stages, the inlet total pressure distortion induces total temperature distortion at the compressor outlet, and the inlet pressure distortion reduces the engine thrust and increases its specific fuel consumption. The test data also show that there is probably a correlation between temperature distributions at the turbine outlet and the compressor outlet.

Author (revised by AIAA)

Aircraft Engines; Inlet Flow; Flow Distortion; Turbojet Engines

19980022479

Light aircraft propeller - Design parameter effects on acoustics and aerodynamics

Chusseau, M., Societe de Construction Avions de Tourisme et Affaires, France; Roozen, E., Ecole Nationale Superieure de l'Aeronautique et de l'Espace, France; Pauzin, S., ONERA, Centre d'Etudes et Recherches de Toulouse, France; Matharan, P., Societe de Construction Avions de Tourisme et Affaires, France; Carrere, A., ONERA, Centre d'Etudes et Recherches de Toulouse, France; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4443; Copyright; Avail: Aeroplus Dispatch

This paper deals with an acoustic and aerodynamic parametrical study of a light airplane propeller. The analysis of generated sound mechanisms leads to an analytical formulation which is a sum of blade passing frequency harmonics. Hanson's (1979) formulation is used for acoustic sound pressure calculations while aerodynamics investigations are carried out with a model based on lifting line theory. In the first part, the validity of the acoustic method is achieved with experimental measurement comparisons and bibliographic results. Next, in order to obtain a decrease of noise with the same performances, the propeller geometry parametrical study shows that a compromise between acoustics and aerodynamics is necessary. The influence of number of blades, scale blade, and chord distribution is analyzed.

Author (AIAA)

Light Aircraft; Aeroacoustics; Propellers; Aircraft Noise; Sound Pressure

19980022896

The effect of axial velocity ratio, turbulence intensity, incidence, and leading edge geometry on the midspan performance of a turbine cascade

Whitehouse, D. R., AECL Research, Whiteshell Labs., Canada; Moustapha, S. H., Pratt & Whitney Canada, Longueuil; Carleton Univ., Ottawa; Sjolander, S. A., Carleton Univ., Canada; Canadian Aeronautics and Space Journal; Sep. 1993; ISSN 0008-2821; Volume 39, no. 3, pp. 150-156; In English; Copyright; Avail: Aeroplus Dispatch

A series of off-design loss measurements have been performed on a turbine blade cascade of recent design to determine the effect of the axial velocity ratio (AVR), freestream turbulence intensity, incidence, and leading edge geometry on the midspan performance. A blade was designed with a leading-edge diameter almost twice that of another blade that had identical aerodynamic parameters. Experimental results indicate that the two blades have similar off-design losses. Measurements made at differ-

ent values of AVR showed the strong sensitivity of the blade losses to 2D flow conditions. Increased levels of turbulence intensity had little effect on the blade's off-design performance.
Author (AIAA)
Aircraft Engines; Airfoil Profiles; Engine Design; Turbine Blades; Leading Edges; Turbulence Effects

19980022900

Experimental studies on mixing of two co-axial high-speed streams

Narayanan, A. K., Indian Inst. of Technology, India; Damodaran, K. A., Indian Inst. of Technology, India; Journal of Propulsion and Power; Feb. 1994; ISSN 0748-4658; Volume 10, no. 1, pp. 62-68; In English; Copyright; Avail: Aeroplus Dispatch

The enhancement of mixing between two high speed gaseous streams is a major technical problem for many aerospace propulsion systems currently under development. A lobe-type 'petal' convergent-divergent supersonic nozzle has been developed and tested in order to achieve large-scale secondary flows for low-loss, high-efficiency mixing. Nearly complete mixing has by this means been achieved within a coaxial short mixing chamber.
AIAA
Turbulent Mixing; Secondary Flow; Supersonic Nozzles; Momentum Transfer

19980022908

Internal reversing flow in a tailpipe offtake configuration for ASTOVL aircraft

McArdle, Jack G., NASA Lewis Research Center, USA; Esker, Barbara S., NASA Lewis Research Center, USA; Rhodes, James A., McDonnell Douglas Aerospace Co., USA; Journal of Propulsion and Power; Feb. 1994; ISSN 0748-4658; Volume 10, no. 1, pp. 122-128; In English
Report No.(s): AIAA Paper 92-3790; Copyright; Avail: Aeroplus Dispatch

No abstract available.
Exhaust Systems; Performance Tests; Powered Lift Aircraft; Reversed Flow; V/STOL Aircraft

19980022913

Dynamic turbine blade temperature measurements

Becker, William J., Virginia Polytechnic Inst. and State Univ., Blacksburg, USA; Roby, Richard J., Virginia Polytechnic Inst. and State Univ., Blacksburg; O'Brien, Walter F., Virginia Polytechnic Inst. and State Univ., Blacksburg; Bensing, Gerald K., Rosemount, Inc., Aerospace Div., USA; Journal of Propulsion and Power; Feb. 1994; ISSN 0748-4658; Volume 10, no. 1, pp. 69-78; In English
Report No.(s): AIAA Paper 89-2689; Copyright; Avail: Aeroplus Dispatch

No abstract available.
Aerothermodynamics; Aircraft Engines; Surface Temperature; Temperature Measurement; Turbine Blades; Turbofan Engines

19980022929

Numerical simulation of cold mixing in the supersonic combustor of dual-combustion ramjets (DCR)

Suo, Jianqin, Beijing Univ. of Aeronautics and Astronautics, China; Ma, Jihua, Beijing Univ. of Aeronautics and Astronautics, China; Jin, Rushan, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Propulsion Technology; Oct. 1993; ISSN 1001-4055, no. 5, pp. 8-16; In Chinese; Copyright; Avail: Aeroplus Dispatch

The flowfield characteristics created by a sonic jet flow between two supersonic streams were investigated theoretically by solving full 2D N-S equations. A computer program is developed to analyze the viscous flowfield of cold mixing of a sortie jet flow with two supersonic streams by using a MacCormack explicit scheme. An algebraic method is used in this study to generate computational grids. The agreement of computations with experimental results is satisfactory.
Author (revised by AIAA)
Supersonic Combustion Ramjet Engines; Subsonic Flow; Two Dimensional Models; Flow Characteristics; Mixing Layers (Fluids)

19980022975

Constrained quadratic programming, active control of rotating mass imbalance

Manchala, D. W., Xerox Corp., USA; Palazzolo, A. B.; Kascak, A. F.; Montague, G. T.; Brown, G. V.; Journal of Sound and Vibration; September 04, 1997; ISSN 0022-460X; Volume 205, no. 5, pp. 561-580; In English; Copyright; Avail: Issuing Activity

Jet engines may experience severe vibration due to the sudden imbalance caused by blade failure. The current research investigates employment of piezoelectric actuators to suppress this using active vibration control. This requires identification of the

source of the vibrations via an expert system, determination of the required phase angles and amplitudes for the correction forces, and application of the desired control signals to the piezoelectric actuators. Correction forces may exceed the physical limitations of the actuators; hence results of 'constrained force' quadratic programming, least squares and multi-point correction algorithms will be compared. It is demonstrated that simply scaling down the least squares predicted correction forces to satisfy the actuator saturation constraints does not necessarily yield optimal reductions in vibration. In this paper test results are shown for sudden imbalance, and the computational time requirements and balancing effectiveness for the various approaches are compared.
Author (EI)
Active Control; Quadratic Programming; Vibration Damping; Jet Engines; Turbomachine Blades; Piezoelectricity; Actuators

19980023065

Development of a fan noise design system. I - Design system and source modeling

Philbrick, D. A., Pratt & Whitney Group, USA; Topol, D. A., Pratt & Whitney Group, USA; Oct. 1993; In English
Contract(s)/Grant(s): NAS3-25952
Report No.(s): AIAA Paper 93-4415; Copyright; Avail: Aeroplus Dispatch

A theoretical treatment is presented of a noise design system for turbofan engines which encompasses a rotor/stator interaction code predicting tone levels within the duct and an inlet-radiation model to predict the directivity patterns of the noise radiating to the far-field. Attention is here given to improvements of the rotor/stator interaction code's empirical wake modeling. An illustrative example is given for the application of this system in the design of a low-noise turbofan engine.
AIAA
Rotor Body Interactions; Engine Noise; Noise Reduction; Propeller Fans; Control Systems Design

19980023066

Development of a fan noise design system. II - Far-field radiation and system evaluation

Topol, D. A., Pratt & Whitney Group, USA; Oct. 1993; In English
Contract(s)/Grant(s): NAS3-25952
Report No.(s): AIAA Paper 93-4416; Copyright; Avail: Aeroplus Dispatch

The development of a fan tone noise design system for turbofan engines are presented in this paper. The system is divided into source noise and radiation components using linearized acoustic theory. The present system includes a rotor wake/stator interaction noise prediction code and an inlet noise radiation code. The inlet radiation code is presented along with its evaluation and the assessment of the entire design system. The inlet radiation code uses a FEM to propagate noise from engine sources out the engine nacelle inlet to the far field. Advanced Ducted Prop (ADP) rig data from NASA Lewis testing are utilized for this evaluation including the use of mode measurements from a rotating microphone. Results indicate that, given the correct mode content in the engine duct, the inlet radiation code is capable of giving good far-field noise predictions.
Author (revised by AIAA)
Turbofan Engines; Engine Noise; Engine Inlets; Noise Prediction; Sound Fields

19980023068

Estimation of full scale turbofan engine noise from scale model fan rig measurements

Weir, Donald S., AlliedSignal Engines, USA; Marsan, Mehmet, AlliedSignal Engines, USA; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4419; Copyright; Avail: Aeroplus Dispatch

Fan generated discrete tone noise is a very important noise source in high bypass turbofan engines. The present investigation is an experimental study conducted to verify the low noise design of a new fan. This paper presents the results of a spinning mode analysis performed on a half size fan installed in a rig. Modal orders are identified and amplitudes of each propagating mode are presented. The modal analysis is supplemented by far field sound pressure measurements of a full size engine. The measured modal amplitudes are extrapolated to the far field noise measurements points for comparison. The extrapolated levels show similar directivity patterns and levels as the full size engine measurements verifying the design intent of the fan.
Author (AIAA)
Turbofan Engines; Engine Noise; Engine Design; Noise Reduction; Noise Measurement

08
AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

19980020871 Naval Postgraduate School, Monterey, CA USA
Incorporation of a Differential Global Positioning System (DGPS) in the control of an Unmanned Aerial Vehicle (UAV) for Precise Navigation in the Local Tangent Plane (LTP)
Allen, Peyton M., Naval Postgraduate School, USA; Mar. 1997; 74p; In English
Report No.(s): AD-A333402; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The purpose of this thesis is to incorporate the Global Positioning System (UPS) and Inertial Navigation System (INS), for the guidance of an unmanned aerial vehicle (UAV) seeking precise navigation in a Local Tangent Plane (LTP). by applying the Differential Positioning technique, UPS position data becomes more accurate. This position can then be referenced to a known location on the ground in order to give the aircraft's position in the Local Tangent Plane. The FOG-R UAV at the Naval Postgraduate School will be used for autonomous flight testing using a Texas Instruments TMS320C30 Digital Signal Processor (DSP). This DSP is hosted on an IBM compatible PC, and is controlled via Integrated System's AC100 control system design and implementation software package. The UPS receiver used throughout this thesis is a Motorola PVT-6 OEM. Another identical UPS receiver is used as a reference station, thus providing the Differential capability. The objectives of this thesis are: the system must be able to accept current location from the UPS and convert it to LTP, display the LTP coordinates, numerically and graphically, and be able to easily change the origin coordinates. Finally, the achieved accuracy of the differential setup is examined.
DTIC

Global Positioning System; Inertial Navigation; Position (Location); Pilotless Aircraft; Remotely Piloted Vehicles; Remote Control

19980021271 Massachusetts Inst. of Tech., Dept. of Aeronautics and Astronautics, Cambridge, MA USA
Prototype Conflict Alerting System for Free Flight
Kuchar, James K., Massachusetts Inst. of Tech., USA; Yang, Lee C., Massachusetts Inst. of Tech., USA; Journal of Guidance, Control and Dynamics; Aug. 1997; Volume 20, No. 4, pp. 768-773; In English; 35th; Aerospace Sciences Meeting, 6-9 Jan. 1997, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): NASA/CR-97-207293; NAS 1.26:207293; AIAA Paper 97-0220; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The development of a prototype alerting system for a conceptual free flight environment is discussed. The alerting logic is based on a probabilistic model of aircraft sensor and trajectory uncertainties that need not be Gaussian distributions. Monte Carlo simulations are used over a range of encounter situations to estimate conflict probability as a function of intruder position, heading, and speed, as determined through a datalink between aircraft. Additionally, the probability of conflict along potential avoidance trajectories is used to indicate whether adequate space is available to resolve a conflict. Intruder intent information, e.g., flight plan, is not included in the model but could be used to reduce the uncertainty in the projected trajectory. Four alert stages are defined based on the probability of conflict and on the avoidance maneuvers that are available to the flight crew. Preliminary results from numerical evaluations and from a piloted simulator study at NASA Ames Research Center are summarized.
Author

Free Flight; Simulators; Probability Theory; Flight Crews; Monte Carlo Method; Normal Density Functions

19980021298 California Univ., Dept. of Mechanical and Aeronautical Engineering, Davis, CA USA
Robust, Decoupled, Flight Control Design with Rate Saturating Actuators
Snell, S. A., California Univ., USA; Hess, R. A., California Univ., USA; 1997; 13p; In English
Contract(s)/Grant(s): NAG1-1744
Report No.(s): NASA/CR-97-207152; NAS 1.26:207152; AIAA Paper 97-3778; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Techniques for the design of control systems for manually controlled, high-performance aircraft must provide the following: (1) multi-input, multi-output (MIMO) solutions, (2) acceptable handling qualities including no tendencies for pilot-induced oscillations, (3) a tractable approach for compensator design, (4) performance and stability robustness in the presence of significant plant uncertainty, and (5) performance and stability robustness in the presence actuator saturation (particularly rate saturation). A design technique built upon Quantitative Feedback Theory is offered as a candidate methodology which can provide flight

control systems meeting these requirements, and do so over a considerable part of the flight envelope. An example utilizing a simplified model of a supermaneuverable fighter aircraft demonstrates the proposed design methodology.
Author
Robustness (Mathematics); Flight Control; Actuators; Control Systems Design; Fighter Aircraft; MIMO (Control Systems); Controllability

19980021310 Wright State Univ., Dept. of Psychology, Dayton, OH USA
Dynamically Adaptive Interfaces: A Preliminary Investigation ***Interim Report, Jan. 1996 - Mar. 1997***
Bennett, Kevin B., Wright State Univ., USA; Aug. 1997; 41p; In English
Contract(s)/Grant(s): Proj. 7184
Report No.(s): AD-A334286; AL/CF-SR-1997-0007; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A dynamically adaptive interface (DAI) changes it's display or control characteristics based on behavioral or physiologic measures of the human operator in real time. The goal of a dynamically adaptive interface is to anticipate informational needs or desires of the operator and to provide that information without the requirement for an explicit control input. DAIs have the potential to improve overall human machine system performance if properly designed. This report documents an initial exploration of both theoretical and practical issues in dynamically adaptive interfaces. A DAI concept demonstrator was developed to assist in precision low level navigation tasks. Advanced controls (a force reflecting stick) and displays (a flight director display) were incorporated into a dynamically adaptive interface concept demonstrator. A pilot study to evaluate the DAI was conducted. Three experimental conditions were evaluated: a baseline interface (conventional controls and displays), an advanced interface (advanced controls and displays), and an adaptive interface (dynamically alternating between baseline and advanced). The results indicated that there were significant performance advantages associated with both the advanced and adaptive interfaces relative to the baseline interface for tracking the optimal flight path.
DTIC
Air Navigation; Human Performance; Flight Paths; Real Time Operation; Display Devices; Physiology

19980021789 Massachusetts Inst. of Tech., Dept. of Aeronautics and Astronautics, Cambridge, MA USA
Fixed Structure Methods for Flight Control Analysis and Automated Gain Scheduling
Miotto, Piero, Massachusetts Inst. of Tech., USA; Jun. 1997; 258p; In English; Copyright; Avail: Issuing Activity (MIT Libraries, Rm. 14-0551, Cambridge, MA), Hardcopy, Microfiche

Flight control law validation issues raised at NASA Dryden Flight Research Center are described, and these problems are recast into the real-mu analysis framework. to solve these problems, a recently developed algorithm for computing real-mu is extended to include repeated real perturbations. Worst-case direction information also is provided; such information is useful in applications that require proper weighting of the perturbation block structure. An iterative weighting procedure that indicates the relative importance of the real uncertainties being analyzed is described. Other developments motivated by flight-test issues are also described: block structures for analyzing phase margin and transport delay, robustly guaranteed gain and phase margins, and in-flight robustness measurements. These tools and techniques are demonstrated on the X-31 fight control laws. The problem of gain adjustment in an existing control law is cast into the framework of modern control theory, which results in a real-diagonal block structure of gains and time constants to be adjusted. The desire to recover performance in the form of input-output properties, as well as handling qualities, is introduced as a mixed cost functional. Linear Matrix Inequality (LMI) based solutions for H-infinity and H-2 based costs are discussed, as well as a Quasi-Newton approach. The handling qualities of the F/A-18 HARV during refueling serves as a motivating example for the method. Eight gains in the existing flight control system are adjusted to recover the performance and handling qualities of the standard F/A-18. The eight gains are gain scheduled against dynamic and static pressure throughout the flight envelope. The functional dependence of these gains on the scheduling parameters results in the definition of 39 coefficients. A Fixed-Structure Linear Parameter Varying (LPV) synthesis method is used to gain schedule the longitudinal and lateral-directional control augmentation system of the F/A-18. The goal is to retune the control law so that it could be used as the Control Augmentation System (CAS) for the F/A-18 HARV, which has much different dynamics. The example illustrates how modern methods can be used to improve both the handling qualities and the input-output characteristics of an existing control system, and to do so automatically over a wide range of operating conditions. Automated tuning of the gain schedule is achieved via optimization over a large region of the flight envelope. The presented approach is systematic and emphasizes the reuse of conceptual structures and architecture. The CAS with the new gains was implemented on the fixed base NASA Dryden flight simulator. Several tracking maneuvers were performed by six different pilots on the flight simulator. The fine tracking per-

formance of the F/A-18 HARV with the new gain schedule received a Cooper-Harper (CH) rating identical to that of the standard F/A-18 HARV.
Author
Flight Control; Algorithms; Controllability; Control Theory

19980022117

A fast method of computing unsteady airloads for active control of gust load using oscillating flaps in the wind tunnel environment

Chi, Ray M., United Technologies Research Center, USA; Simonich, John C., United Technologies Research Center, USA; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4352; Copyright; Avail: Aeroplus Dispatch

A very efficient and accurate method has been developed to compute the unsteady airloads on a rectangular wing with multiple oscillating flaps, subject to an oblique gust produced by a swept wake in the subsonic wind tunnel. The underlying theory assumes a potential flow model in the frequency domain that leads to an integral equation for the unsteady velocity potential with a known upwash velocity distribution attributed to the combination of gust velocity and flap motion. The kernel of the integral equation is derived analytically using the method of images to take into account the effect of the wind tunnel side walls. The integral equation is solved using the mode expansion technique. The calculated pressure loading results clearly reveal the effectiveness of flap motion in reducing blade loading as observed in the wind tunnel experiment.
Author (AIAA)
Active Control; Gust Loads; Flaps (Control Surfaces); Wind Tunnel Tests; Unsteady Aerodynamics; Mathematical Models

19980022130

Application of approximate I/O linearization to aircraft flight control

Lee, A. W., California Univ., Berkeley, USA; Hedrick, J. K., California Univ., Berkeley; 1992, pp. 57-65; In English; Copyright; Avail: Aeroplus Dispatch

A new design method called approximate I/O linearization is presented which enhances the performance of longitudinal flight control under saturation. A pointwise minimization problem is solved to obtain the new approximate I/O linearization law. The function to be minimized consists of a surface whose related degree is one, its derivative, and the weighted square of the input. The method differs from previously published ones in that no attempt is made to directly transform a nonlinear system into an approximate linear system via coordinate transformation. In this method, the adverse effects of control saturation can be minimized by properly selecting the weight on the usage of the control. The only requirement of the technique is that the original plant be locally I/O linearizable.
AIAA
Flight Control; Linear Equations; Aircraft Control; Approximation

19980022411

High-alpha vectoring characteristics of the F-18/HARV

Asbury, Scott C., NASA Langley Research Center, USA; Capone, Francis J., NASA Langley Research Center, USA; Journal of Propulsion and Power; Feb. 1994; ISSN 0748-4658; Volume 10, no. 1, pp. 116-121; In English

Report No.(s): AIAA Paper 92-3095; Copyright; Avail: Aeroplus Dispatch

No abstract available.
Angle of Attack; F-18 Aircraft; Thrust Vector Control

19980022501

Mixed strategy guidance - A new high-performance missile guidance law

Shinar, J., Technion - Israel Inst. of Technology, Haifa, Israel; Forte, I., Technion - Israel Inst. of Technology, Haifa; Kantor, B., Technion - Israel Inst. of Technology, Haifa; Journal of Guidance, Control, and Dynamics; Feb. 1994; ISSN 0731-5090; Volume 17, no. 1, pp. 129-135; In English

Contract(s)/Grant(s): AF-AFOSR-89-0528; Copyright; Avail: Aeroplus Dispatch

No abstract available.
Missile Control; Radar Homing Missiles; Electronic Countermeasures; Radar Targets

19980022506

Integrated flight/propulsion control - Subsystem specifications

Rock, Stephen M., Stanford Univ., USA; Ememi-Naeini, Abbas, Integrated Systems, Inc., USA; Neighbors, Ken, Stanford Univ., USA; Journal of Guidance, Control, and Dynamics; Feb. 1994; ISSN 0731-5090; Volume 17, no. 1, pp. 201-208; In English
Contract(s)/Grant(s): NAG3-1177; Copyright; Avail: Aeroplus Dispatch

In many systems it is required or desirable to implement a control law in a partitioned or decentralized architecture comprised of subsystems. This paper presents a technique for deriving specifications for each subsystem that, if met, guarantee that total system performance (e.g., stability) goals will be met when the subsystems are combined. The approach is based on the concepts of robust control theory and generates results that are expressed in the frequency domain as allowed error envelopes about nominal requirements. Although emphasis is placed on generating specifications that guarantee only the stability of the combined system, extensions that would guarantee performance are also discussed. The focus of the paper is the integrated flight/propulsion control problem in which specifications on the propulsion system are derived based on the mission-level requirements of the aircraft. However, the results are generally applicable. A numerical example demonstrating the application of the procedure is included.
Author (AIAA)

STOVL Aircraft; Control Systems Design; Aircraft Engines; Engine Control; Systems Integration

19980022507

Invertibility and trajectory control for nonlinear maneuvers of aircraft

Azam, Misbahul, Nevada Univ., Las Vegas, USA; Singh, Sahjendra N., Nevada Univ., Las Vegas; Journal of Guidance, Control, and Dynamics; Feb. 1994; ISSN 0731-5090; Volume 17, no. 1, pp. 192-200; In English; Copyright; Avail: Aeroplus Dispatch

No abstract available.

Aircraft Maneuvers; Trajectory Control; Feedback Control

19980022508

Optimal control of helicopters following power failure

Okuno, Yoshinori, National Aerospace Lab., Japan; Kawachi, Keiji, Tokyo Univ., Japan; Journal of Guidance, Control, and Dynamics; Feb. 1994; ISSN 0731-5090; Volume 17, no. 1, pp. 181-186; In English; Copyright; Avail: Aeroplus Dispatch

No abstract available.

Helicopter Engines; Engine Control; Engine Failure; Optimal Control

19980022519

Design of robust quantitative feedback theory controllers for pitch attitude hold systems

Bossert, David E., U.S. Air Force Academy, USA; Journal of Guidance, Control, and Dynamics; Feb. 1994; ISSN 0731-5090; Volume 17, no. 1, pp. 217-219; In English; Copyright; Avail: Aeroplus Dispatch

No abstract available.

Aircraft Control; Attitude Control; Control Systems Design; Robustness (Mathematics); Feedback Control; Control Theory

19980022520

Evaluation of missile seeker dwell time for three-dimensional aerial engagements

Asthana, C. B., Research Centre Imarat, India; Prahlada, Mr., Research Centre Imarat, India; Journal of Guidance, Control, and Dynamics; Feb. 1994; ISSN 0731-5090; Volume 17, no. 1, pp. 211-214; In English; Copyright; Avail: Aeroplus Dispatch

A 3D engagement is considered with a view to the evaluation of the minimum value of dwell time, which is represented in the form of a nomogram. An analysis is by these means conducted of the engagement parameters that would ensure the given dwell time. The nomogram allows the determination of the circular area around the beam axis, to ensure the required dwell time for acquisition without search; the accuracy requirements for homing subsystems to capture the target in that area are worked out on that basis.
AIAA

Missile Design; Homing Devices; Dwell; Missile Control

19980022673 Dynetics, Inc., Huntsville, AL USA

Prediction of Hinge Moment Coefficient for Nose-Mounted Canard Controls at Supersonic Speeds ***Final Report, Aug. 1996 - Aug. 1997***

Landers, Michael G., Dynetics, Inc., USA; Aug. 1997; 119p; In English
Contract(s)/Grant(s): DAAH01-96-C-R194

Report No.(s): AD-A331810; AMSAM-CR-RD-SS-97-49; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The prediction of nose-mounted canard hinge moments in supersonic flow poses a unique problem for which the semi-empirical methods utilized in engineering-level aerodynamic prediction codes may not provide sufficient accuracy for preliminary design of the control actuation system. While providing accurate predictions of canard normal force, such codes generally cannot adequately predict canard hinge moments due to both their empirical nature and inability to address the local flowfield conditions on the rocket nose. It has been shown in this report that the local flowfield properties must be characterized to accurately determine the longitudinal center-of-pressure of the canards. A theoretical approach has been develop ed to predict normal force coefficient, longitudinal center-of-pressure, and subsequent hinge moment coefficient for nose-mounted canards. The method is based on shock-expansion theory and airfoil strip theory, and accounts for local flowfield properties, tip pressure losses, and body carryover effects. In contrast to aerodynamic code predictions, the theoretical method consistently estimates canard longitudinal center-of-pressure with a higher degree of accuracy, resulting in good agreement with experimental data for nose-mounted canard hinge moments at Mach 1.25 to 2.00.

DTIC

Supersonic Flow; Canard Configurations; Airfoils

19980022679 California Univ., Dept. of Mechanical and Aeronautical Engineering, Davis, CA USA

Assessing Aircraft Susceptibility to Nonlinear Aircraft-Pilot Coupling/Pilot-Induced Oscillations

Hess, R.A., California Univ., USA; Stout, P. W., California Univ., USA; 1997; 11p; In English

Contract(s)/Grant(s): NAG1-1744

Report No.(s): NASA/CR-97-207296; NAS 1.26:207296; AIAA Paper 97-3496; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A unified approach for assessing aircraft susceptibility to aircraft-pilot coupling (or pilot-induced oscillations) which was previously reported in the literature and applied to linear systems is extended to nonlinear systems, with emphasis upon vehicles with actuator rate saturation. The linear methodology provided a tool for predicting: (1) handling qualities levels, (2) pilot-induced oscillation rating levels and (3) a frequency range in which pilot-induced oscillations are likely to occur. The extension to nonlinear systems provides a methodology for predicting the latter two quantities. Eight examples are presented to illustrate the use of the technique. The dearth of experimental flight-test data involving systematic variation and assessment of the effects of actuator rate limits presently prevents a more thorough evaluation of the methodology.

Author

Assessments; Aircraft Pilots; Nonlinear Systems; Magnetic Permeability

19980022910

Theoretical study of sensor-actuator schemes for rotating stall control

Hendricks, G. J., MIT, USA; Gysling, D. L., MIT, USA; Journal of Propulsion and Power; Feb. 1994; ISSN 0748-4658; Volume 10, no. 1, pp. 101-109; In English

Report No.(s): AIAA Paper 92-3486; Copyright; Avail: Aeroplus Dispatch

No abstract available.

Active Control; Actuators; Rotating Stalls; Turbocompressors; Pressure Measurement

19980022919

An integrated GPS/DR navigation system for mini remotely piloted vehicles

Li, Yan, Northwestern Polytechnical Univ., China; Zhou, Qi, Northwestern Polytechnical Univ., China; Wong, Xiangying, Northwestern Polytechnical Univ., China; Northwestern Polytechnical University, Journal; Oct. 1993; ISSN 1000-2758; Volume 11, no. 4, pp. 419-423; In Chinese; Copyright; Avail: Aeroplus Dispatch

The present integrated GPS/dead reckoning (DR) navigation system for mini-RPVs, which has been developed as an alternative to GPS/INS systems, offers low cost, small size, lightness, and simplicity. The model used by the guidance system takes the dynamic attitude parameters of the RPV into account, and is shown to yield a level of navigational accuracy that is several orders of magnitude higher than that of the original DR algorithm. A Monte Carlo simulation of its operations shows its efficiency, quick convergence, and high tracking performance.

AIAA

Global Positioning System; Remotely Piloted Vehicles; Navigation Aids; Position (Location)

19980022920

Self-tuning control for gust alleviation of terrain following system

Liu, Xilin, Northwestern Polytechnical Univ., China; Xiao, Shunda, Northwestern Polytechnical Univ., China; Northwestern Polytechnical University, Journal; Oct. 1993; ISSN 1000-2758; Volume 11, no. 4, pp. 413-418; In Chinese; Copyright; Avail: Aeroplus Dispatch

A self-tuning control system is proposed which can preclude the effects of gusts on the trajectory of aircraft terrain-following guidance systems. This implicit generalized minimum variance pole-assignment algorithm for a MIMO system uses two sets of parameter-estimation equations; while one establishes the control law, the other is independent of weighting matrices and thereby allows a regulation of weighting matrices on-line, for realization of pole-alignment. Convergence of weighting matrices is in this way expedited, and parallel pole-alignment and control-law computations can be conducted.

AIAA

Control Theory; Aircraft Control; MIMO (Control Systems); Gust Alleviators

19980023051

H-infinity design of F/A-18A automatic Carrier Landing System

Subrahmanyam, M. B., U.S. Navy, Naval Air Warfare Center, USA; Journal of Guidance, Control, and Dynamics; Feb. 1994; ISSN 0731-5090; Volume 17, no. 1, pp. 187-191; In English; Copyright; Avail: Aeroplus Dispatch

In this paper a design of the F/A-18A Automatic Carrier Landing System is accomplished using finite horizon H-infinity techniques. If the final time is sufficiently large, the dynamic Riccati equations involved in the design give rise to constant solutions. Making use of a suboptimal value of performance, an output feedback controller is synthesized. Only longitudinal equations of motion are considered and thrust is incorporated as a control variable. The objective of the design is to maintain a constant flight path angle under worst case conditions of vertical gust and sensor noise during carrier landing. The design yields satisfactory response for vertical rate command as well.

Author (revised by AIAA)

F-18 Aircraft; Automatic Landing Control; Aircraft Carriers; H-Infinity Control; Control Systems Design

19980023053

Missile guidance algorithm against high-g barrel roll maneuvers

Imado, Fumiaki, Mitsubishi Electric Corp., Japan; Miwa, Susumu, Tokyo Denki Univ., Japan; Journal of Guidance, Control, and Dynamics; Feb. 1994; ISSN 0731-5090; Volume 17, no. 1, pp. 123-128; In English; Copyright; Avail: Aeroplus Dispatch

The features of high-g barrel rolls for an aircraft and the countermeasures for a proportional navigation guidance missile against this maneuver are studied. First, the features of the barrel roll maneuver, and the effects of the parameters on the miss distance are discussed. The simulation results show that a high-g barrel roll maneuver generally produces a larger miss distance than a split-S (a sustained maximum g turn) and the miss distance does not critically depend on the maneuver initiation time, if the aircraft has a certain length of ’time-to-go’ and maneuvers with an appropriate roll rate. Second, the inference is made that the provision of a phase lead in the pitch-yaw plane in the missile guidance loop and adoption of the augmented proportional navigation guidance may be effective. It is also proven that a large phase shift results in a smaller miss distance and that the combination of the phase lead and the augmented proportional navigation produces better results.

Author (AIAA)

Missile Control; Rolling Moments; Proportional Control; Aircraft Maneuvers

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

19980019581

Airport trains complete first phase of tests

Railway Gazette International; August, 1997; ISSN 0373-5346; Volume 153, no. 8, pp. 512; In English; Copyright; Avail: Issuing Activity

Ten weeks of trials with one of the first trains for Hong Kong MTR Corp’s airport line culminated in a media presentation on July 2 at Adtranz works in Henningdorf near Berlin. The rain had previously undergone static tests in Spain following assembly by CAF and was due to be shipped this month to Hong Kong for final trials and commissioning. According to project manager

David Barry, the trials have not revealed any serious problems, although some work will be necessary to reduce noise levels. Noise is one of several demanding areas in MTR Corp's specification: safety, electromagnetic compatibility, ease of maintenance, reliability, and fire protection are others. Performance of individual components and whole trains is to be monitored and checked continuously during design and commissioning.
Author (revised by EI)
Airports; Ground Support Equipment; Passengers; Transportation; Rail Transportation

19980019861 NASA Lewis Research Center, Cleveland, OH USA
Alignment and Initial Operation of an Advanced Solar Simulator
Jaworske, Donald A., NASA Lewis Research Center, USA; Jefferies, Kent S., NASA Lewis Research Center, USA; Mason, Lee S., NASA Lewis Research Center, USA; Journal of Spacecraft and Rockets; Dec. 1996; Volume 33, No. 6, pp. 867-869; In English
Report No.(s): NASA/TM-96-207373; NAS 1.15:207373; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A solar simulator utilizing nine 30-kW xenon arc lamps was built to provide radiant power for testing a solar dynamic space power system in a thermal vacuum environment. The advanced solar simulator achieved the following values specific to the solar dynamic system: (1) a subtense angle of 1 deg; (2) the ability to vary solar simulator intensity up to 1.7 kW/sq m; (3) a beam diameter of 4.8 m; and (4) uniformity of illumination on the order of +/-10%. The flexibility of the solar simulator design allows for other potential uses of the facility.
Author
Solar Simulators; Solar Cells; Arc Lamps; Xenon Lamps; Solar System; Spacecraft Power Supplies; Solar Generators

19980020149 Central Lab. of the Research Councils, Daresbury Lab., Warrington, UK
Design, Construction and Testing of a Multipole Wiggler Magnet Titanium Vacuum Chamber for the SRS
Bliss, N., Central Lab. of the Research Councils, UK; Dawson, C. L., Central Lab. of the Research Councils, UK; Oct. 1997; ISSN 1362-0193; 12p; In English; 1997 Particle Accelerator Conference, 1997, Vancouver, Canada
Report No.(s): PB98-117377; DL-P-97-003; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A vacuum chamber is required for two new insertion devices (IDs) at the SRS. The chamber has been designed, finite element analysis performed, and a prototype constructed and successfully tested. The chamber is 1208 mm in length, it has an internal aperture of 134 mm x 16 mm and a minimum wall thickness of 1 mm. The chamber has been precision machined in two halves from titanium alloy and electron beam (EB) welded in order to meet the demanding tolerances. Titanium alloy was selected in preference to more conventional ultra high vacuum (UHV) materials, due to its electron beam weldability, low distortion and outgassing rates. The design, construction and processing has been conducted to UHV standards to achieve a working pressure of 1 x 10(EXP -9) mbar.
NTIS
Vacuum Chambers; Titanium Alloys; Finite Element Method; Performance Tests; Wiggler Magnets

19980020253 National Simulation Center, Fort Leavenworth, KS USA
Operational Requirements Document (ORD) for Warfighters' Simulation (WARSIM) 2000, 3.7
Sep. 26, 1997; 36p; In English
Report No.(s): AD-A335027; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

WARSIM 2000 will increase the effectiveness of commander and staff training, exercises, and staff mission rehearsals by dramatically increasing the realism and the scope of the available training environment. In conjunction with other simulations, WARSIM 2000 will provide a complete operational environment with scenarios covering the range of military operations within the stages of force projection operations to support globally distributed Army, joint, and coalition force task-based training.
DTIC
Computerized Simulation; Armed Forces (USA); Training Devices

19980022892
A giant simulator of sonic boom and aircraft noise
Ahuja, K. K., Georgia Inst. of Technology, Atlanta, USA; Stevens, J. C., Georgia Inst. of Technology, Atlanta; Walterick, R. E., Georgia Inst. of Technology, Atlanta; Oct. 1993; In English
Contract(s)/Grant(s): NAS1-19061
Report No.(s): AIAA Paper 93-4430; Copyright; Avail: Aeroplus Dispatch

The objective of the study described here was to construct a facility capable of reproducing simulated sonic booms and other low frequency sound (as low as 3 Hz) at peak sound pressure levels (SPL) of approximately 130 dB as measured on the exterior

wall of a residential building. The facility was to be constructed so that human response could be studied both outdoors and indoors. This paper describes the completed facility which consists of unique low-frequency, high-power drivers and several more conventional loud speakers, which in combination span the frequency range from 3 Hz to 4 kHz. A residential building was provided by Georgia Tech to study the indoor response.
Author (AIAA)
Aircraft Noise; Sonic Booms; Noise Pollution; Environment Effects; Biological Effects

19980022905

Facility opportunities and associated stream chemistry considerations for hypersonic air-breathing propulsion

Chinitz, Wallace, General Applied Science Labs., Inc., USA; Erdos, John I., General Applied Science Labs., Inc., USA; Rizkalla, Oussama, General Applied Science Labs., Inc., USA; Anderson, G. Y., NASA Langley Research Center, USA; Bushnell, Dennis M., NASA Langley Research Center, USA; Journal of Propulsion and Power; Feb. 1994; ISSN 0748-4658; Volume 10, no. 1, pp. 6-17; In English
Report No.(s): AIAA Paper 92-3991; Copyright; Avail: Aeroplus Dispatch

Ground test requirements for the hypersonic air-breathing propulsion systems and the related facilities are examined. Emphasis is given to issues of stream chemistry in propulsion facilities and simulation requirements at the upper hypersonic-hypervelocity range approaching orbital speed. It is concluded that only the free piston-driven expansion tunnel offers a near-term opportunity to achieve the total pressures required for direct connect and freejet engine tests out to orbital speeds.
AIAA
Air Breathing Engines; Hypersonic Vehicles; Test Facilities; Combustion Chemistry; Reaction Kinetics

10
ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; space communications, spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

19980021457

First flight vehicle controlled by computer generated software

Mirab, H., Integrated Systems, Inc., UK; Tubb, F., Integrated Systems, Inc., UK; 1993, pp. 653-664; In English; Copyright; Avail: Aeroplus Dispatch

The Multiple Sensor Technology Integration (MSTI) satellite program's payload is a scanning focal-plane array IR sensor. An account is given of MSTI's rapid-prototyping methodology, which facilitated the development of operational flight software in less than 14 months; MSTI is the first spacecraft which employs automatically-generated real-time flight software. A majority of the design specification errors and implementation bugs were discovered in the course of simulation, before any coding was done.
AIAA
Spacecraft Control; Flight Control; Computer Programs; Software Engineering; Control Systems Design; Prototypes

19980022425

Methods and facilities for qualifying the electrical systems and software of the Ariane 5 European Launch Vehicle

Auvray, G., Aerospatiale, France; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4544; Copyright; Avail: Aeroplus Dispatch

The Ariane 5 launcher is the new generation of the European Ariane launcher family. It allows for a major improvement of the payload capacity and a better reliability. The Ariane 5 avionics is fully redundant and uses new concepts for the redundancy design and the on-board software development. The validation and the qualification of the Electricals and Software Systems need a dedicated powerful tool which is called: the Functional Simulation Facility (ISF). After a brief description of the Ariane 5 launcher avionics, this paper presents the validation and qualification process and describes the different simulators: equipment and stages behavior simulator and launcher dynamic simulator. It shows how these different simulators are used all along the incremental validation process and how they are integrated for the final qualification activity.
Author (revised by AIAA)
Ariane Launch Vehicle; Spacecraft Electronic Equipment; Onboard Data Processing; Flight Control; Avionics; Software Development Tools

19980022502

Approach navigation for delivery of small landers to the surface of Mars

Hechler, M., ESA, European Space Operations Centre, Germany; Lauer, M., ESA, European Space Operations Centre, Germany; Journal of Guidance, Control, and Dynamics; Feb. 1994; ISSN 0731-5090; Volume 17, no. 1, pp. 116-122; In English; Copyright; Avail: Aeroplus Dispatch

No abstract available.

Mars Surface; Mars Landing; Planetary Orbits; Spacecraft Maneuvers; Approach Control

19980022749

Co-operating neural approach for spacecrafts attitude control

Apolloni, B., Univ. of Milan, Italy; Battini, F.; Lucisano, C.; Neurocomputing; September 15, 1997; ISSN 0925-2312; Volume 16, no. 4, pp. 279-307; In English; Copyright; Avail: Issuing Activity

A locally recurrent neural network is described as a key component of a control system able to rule an artificial satellite whose attitude must be kept close to zero-angle with respect to an inertial reference system earth centred. The main idea is to join a simple linear adaptive controller with a neural network trained to compensate the inadequacy of the former. The control signal is the sum of the signal computed by the two devices; the feedback for training the neural network comes from the attitude error with respect to a reference trajectory and is computed by means of a linear inversion of the satellite dynamics. Thanks to such co-operation, the resulting system is easily trainable and performs efficiently. In fact, the whole system acts as a MRAC controller whose accuracy has been tested on numerical simulations of an Olympus class spacecraft. Considerations on stability, reactions to unexpected solicitations, extension to non-geocentric missions and power consumption are included as well.

Author (EI)

Approach Control; Attitude Control; Neural Nets; Linear Systems; Spacecraft; Computerized Simulation

11
CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; propellants and fuels; and materials processing.

19980020962 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

The Fate and Transport of Airborne JP-4 and JP-8 Aerosol During Cold Startup

Buckman, Bradford Eugene, Air Force Inst. of Tech., USA; Dec. 1997; 108p; In English

Report No.(s): AD-A334409; AFIT/GEE/ENC/97D-02; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

During cold startup (engine warm-up) procedures at northern tier bases, fuel aerosol (JP-4 and JP-8) is emitted before complete combustion of the fuel occurs. The time necessary for complete combustion to occur may be as long as 10 minutes. Hence, during these first few minutes, aerosol is emitted at relatively high concentrations. This research investigates the principle behavior of the emitted aerosol: advection, dispersion, evaporation, and settling. Using previous work in fuel jettisoning and evaporation as a foundation, this thesis investigates the physical factors affecting the airborne concentration of fuel aerosol at different times, the amount of fuel aerosol reaching the ground, and the times and distances necessary for the aerosol concentration to fall below the hydrocarbon standard after being emitted. Physical assumptions in the model are presented, and various atmospheric conditions are simulated for comparison.

DTIC

Advection; Hydrocarbons; JP-4 Jet Fuel; JP-8 Jet Fuel; Aerosols; Emittance; Combustion

19980021309 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia

On Obtaining Design Allowables for Adhesives Used in the Bonded-Composite Repair of Aircraft

Chalkley, Peter, Defence Science and Technology Organisation, Australia; vandenBerg, John, Defence Science and Technology Organisation, Australia; Jan. 1998; 34p; In English; Original contains color illustrations

Report No.(s): DSTO-TR-0608; AR-010-413; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

A technique is documented, along with its experimental validation, for obtaining engineering-standard design allowables for structural adhesives used in the bonded-composite repair of aircraft structure. The design of durable bonded-composite repairs is reliant on such design allowables. It is intended that allowables obtained using this technique replace the manufacturer's bro-

chure data that is currently in use for some adhesives. Design allowables for the most common repair adhesive, FM73, were obtained as part of the experimental validation.
Author
Adhesives; Composite Materials; Composite Structures; Aircraft Structures

19980022183 Analytical Services and Materials, Inc., Hampton, VA USA
Catalogue of X-Ray Texture Data for Al-Cu-Li Alloy 1460, 2090, 2096 and 2195 Near-Net-Shape Extrusions, Sheet and Plate
Hales, Stephen J., Analytical Services and Materials, Inc., USA; Hafley, Robert A., Analytical Services and Materials, Inc., USA; Alexa, Joel A., Analytical Services and Materials, Inc., USA; Feb. 1998; 170p; In English
Contract(s)/Grant(s): NAS1-19708; RTOP 522-12-51-01
Report No.(s): NASA/CR-1998-206924; NAS 1.26:206924; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The effect of crystallographic texture on the mechanical properties of near-net-shape extrusions is of major interest ff these products are to find application in launch vehicle or aircraft structures. The objective of this research was to produce a catalogue containing quantitative texture information for extruded product, sheet and plate. The material characterized was extracted from wide, integrally stiffened panels fabricated from the Al-Cu-Li alloys 1460, 2090, 2096 and 2195. The textural characteristics of sheet and plate products of the same alloys were determined for comparison purposes. The approach involved using X-ray diffraction to generate pole figures in combination with orientation distribution function analysis. The data were compiled as a function of location in the extruded cross-sections and the variation in the major deformation- and recrystallization-related texture components was identified.
Author
Copper Alloys; Lithium Alloys; Aluminum Alloys; X Ray Diffraction; Extruding; Textures; Catalogs (Publications); Crystallography; Aircraft Structures; Launch Vehicles

19980022713 Southwest Research Inst., TARDEC Fuels and Lubricants Research Facility, San Antonio, TX USA
Elastomeric Tank Life Extension Studies, Part 2 ***Interim Report, Mar. 1990 - Jun. 1997***
Fodor, G. E., Southwest Research Inst., USA; Jan. 1998; 94p; In English
Contract(s)/Grant(s): DAAK70-92-C-0059
Report No.(s): AD-A334609; TFLRF-326-Pt-2; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Time-dependent performances of an epichlorohydrin, a nitrile-based, and three polyurethane-type coated-fabric collapsible fuel tank s were evaluated under subtropical outdoor exposure conditions. These five products were filled with a referee grade diesel fuel and a JP-5/JP-8 ST special test turbine fuel. Data obtained from the fuel-filled tanks were compared to those of empty, fuel-free control products. Results indicated that all examined polyurethane tanks were substantially inferior to those fabricated from an epichlorohydrin or a nitrile product, with the later coated-fabric material being superior.
DTIC
Elastomers; Fuel Tanks; Nitriles; JP-5 Jet Fuel; JP-8 Jet Fuel; Polyurethane Resins; Diesel Fuels

19980022938
Experimental study of fuel concentration distribution using high-density kerosene
Wang, Jian, 31st Research Inst., China; Wang, Jiahua, Nanjing Aeronautical Inst., China; Journal of Propulsion Technology; Oct. 1993; ISSN 1001-4055, no. 5, pp. 42-45; In Chinese; Copyright; Avail: Aeroplus Dispatch

In the experiment, a CO2 infrared analyzer and a sampling probe are used to measure the fuel spray characteristics of high-density kerosene and aviation kerosene downstream from a simple orifice injector. The effects of air flow velocity, pressure drop, and distance from the injector on the fuel concentration distribution are studied. The test results show that, under the same conditions, the maximum concentration for conventional jet fuel is higher than that for high-density kerosene, and the effects of air flow velocity and fuel pressure on the penetration of maximum concentration are stronger for high-density kerosene than for conventional jet fuel.
Author (revised by AIAA)
Kerosene; Jet Engine Fuels; Fuel Injection; Fuel Sprays

12
ENGINEERING

Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

19980019624 NASA Ames Research Center, Moffett Field, CA USA

Comparison of Coupled Radiative Flow Solutions with Project Fire 2 Flight Data

Olynick, David R., NASA Ames Research Center, USA; Henline, W. D., NASA Ames Research Center, USA; Chambers, Lin Hartung, NASA Ames Research Center, USA; Candler, G. V., NASA Ames Research Center, USA; Journal of Thermophysics and Heat Transfer; Dec. 1995; Volume 9, No. 4, pp. 586-594; In English; 6th; Joint Thermophysics and Heat Transfer Conference, 20-23 Jun. 1994, Colorado Springs, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): NASA/TM-95-207283; NAS 1.15:207283; AIAA Paper 94-1955; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A nonequilibrium, axisymmetric, Navier-Stokes flow solver with coupled radiation has been developed for use in the design or thermal protection systems for vehicles where radiation effects are important. The present method has been compared with an existing now and radiation solver and with the Project Fire 2 experimental data. Good agreement has been obtained over the entire Fire 2 trajectory with the experimentally determined values of the stagnation radiation intensity in the 0.2-6.2 eV range and with the total stagnation heating. The effects of a number of flow models are examined to determine which combination of physical models produces the best agreement with the experimental data. These models include radiation coupling, multitemperature thermal models, and finite rate chemistry. Finally, the computational efficiency of the present model is evaluated. The radiation properties model developed for this study is shown to offer significant computational savings compared to existing codes.

Author

Thermal Protection; Navier-Stokes Equation; Computational Fluid Dynamics; Axisymmetric Flow; Nonequilibrium Flow; Aerothermodynamics; Fluid Flow

19980020159 NASA Langley Research Center, Hampton, VA USA

Spiral Microstrip Antenna with Resistance

Shively, David G., Inventor, NASA Langley Research Center, USA; Jan. 27, 1998; 10p; In English; Continuation of abandoned US-Patent-Appl-SN-269268, filed 28 Jun. 1994

Patent Info.: Filed 17Apr. 1996; NASA-Case-LAR-15088-2; US-Patent-5,712,647; US-Patent-Appl-SN-633713; US-Patent-Appl-SN-269268; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A spiral microstrip antenna having resistor elements embedded in each of the spiral arms is provided. The antenna is constructed using a conductive back plane as a base. The back plane supports a dielectric slab having a thickness between one-sixteenth and one-quarter of an inch. A square spiral, having either two or four arms, is attached to the dielectric slab. Each arm of the spiral has resistor elements thereby dissipating an excess energy not already emitted through radiation. The entire configuration provides a thin, flat, high gain, wide bandwidth antenna which requires no underlying cavity. The configuration allows the antenna to be mounted conformably on an aircraft surface.

Official Gazzette of the U.S. Patent and Trademark

Microstrip Antennas; Spiral Antennas; Resistors; Aircraft Antennas

19980020355

Theoretical and experimental study of hyperbolic and degenerate mixing regions in a chaotic Stokes flow

Hackborn, W. W., Augustana Univ. Coll., Canada; Ulucakli, M. E.; Yuster, T.; Journal of Fluid Mechanics; September 10, 1997; ISSN 0022-1120; Volume 346, pp. 23-48; In English; Copyright; Avail: Issuing Activity

We examine the rotor-oscillator flow, a slow viscous flow between long parallel plates driven by the rotation of a slender cylinder (the rotor) and the longitudinal oscillation of one of the plates (the oscillator). For rotor locations of interest to us, this flow exhibits a hyperbolic mixing region, characterized by homoclinic tangling associated with a hyperbolic fixed point, and a degenerate mixing region, characterized by heteroclinic tangling associated with two degenerate fixed points on one of the boundary plates (normally the oscillator). These mixing regions are investigated both theoretically, by applying various dynamical tools to a mathematical model of the flow, and experimentally, by observing the advection of a passive tracer in a specially constructed apparatus. Although degenerate mixing regions have been largely ignored or undervalued in previous research on chaotic mixing, our results demonstrate that more mixing is associated with the degenerate mixing region than the hyperbolic one in many cases.

We have also discovered a peculiar phenomenon, which we call Melnikov resonance, involving a rapid fluctuation in the size of the hyperbolic mixing region as the frequency of the oscillator is varied.
Author (EI)
Stokes Flow; Viscous Flow; Rotors; Mixing; Mechanical Oscillators; Cylindrical Bodies

19980020455
Transonic flow of dense gases around an airfoil with a parabolic nose
Rusak, Zvi, Rensselaer Polytechnic Inst., USA; Wang, Chun-Wei; Journal of Fluid Mechanics; September 10, 1997; ISSN 0022-1120; Volume 346, pp. 1-21; In English; Copyright; Avail: Issuing Activity

Transonic potential flow of dense gases of retrograde type around the leading edge of a thin airfoil with a parabolic nose is studied. The analysis follows the approach of Rusak (1993) for a perfect gas. Asymptotic expansions of the velocity potential function are constructed in terms of the airfoil thickness ratio in an outer region around the airfoil and in an inner region near the nose. The outer expansion consists of the transonic small-disturbance theory for dense gases, where a leading-edge singularity appears. Analytical expressions are given for this singularity by constructing similarity solutions of the governing nonlinear equation. The inner expansion accounts for the flow around the nose, where a stagnation point exists. A boundary value problem is formulated in the inner region for the solution of an oncoming uniform sonic flow with zero values of the fundamental derivative of gasdynamics (, = 0) and the second nonlinearity parameter (Lambda = 0) around a parabola at zero angle of attack. The numerical solution of the inner problem results in a symmetric flow around the nose. The outer and inner expansions are matched asymptotically resulting in a uniformly valid solution on the entire airfoil surface. In the leading terms, the flow around the nose is symmetric and the stagnation point is located at the leading edge for every transonic Mach number, and small values of, and Lambda of the oncoming flow and any shape and small angle of attack of the airfoil. Furthermore, analysis of the inner region in the immediate neighbourhood of the stagnation point reveals that the flow is purely subsonic, approaching critical conditions in the limit of large (scaled) distances, which excludes the formation of shock discontinuities in the nose region.
Author (EI)
Gas Density; Gas Flow; Mach Number; Transonic Flow; Gas Dynamics; Airfoils; Nonlinear Equations; Boundary Value Problems

19980020545 Technische Univ., FG Bionik and Evolutionstechnik, Berlin, Germany
Experimental Studies on the Boundary Layer Development in Penguins: Mechanisms of Turbulence Control and Their Applicability to Engineering
Bannasch, R., Technische Univ., Germany; Feb. 1998; 3p; In English; Also announced as 19980020532; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

Experimental studies conducted on live penguins as well as measurements with life-sized models of their trunk in a water tank revealed extremely low drag coefficients, although there was some evidence that transition from laminar to turbulent near-wall flow occurred in the most frontal part of their body. At a Reynolds number of 3 x 10(exp 6) the drag coefficients were 20-35% lower than those reported for the best turbulent technical bodies. Contrary to fish and dolphins, the penguin’s trunk does not contribute to thrust production. Trunk oscillations during a wing beat cycle are moderate. Therefore, the spindle-like penguin trunk may well serve as live example for how energy may be saved by shape optimization of stiff bodies. The trunk of these birds is relatively short and thick, thus offering a large volume with minimum drag. Using the arithmetic means of data on body geometry from three medium sized penguin species, an axisymmetric body was constructed. by drag measurements in a water tank, this body of revolution was found to be an excellent low-drag laminar body (e.g. the lowest frontal drag coefficient was c(sub wf) = 0,0156, measured at Re(sub D) = 2,331 x 10(exp 5). When the transition from laminar to turbulent flow was triggered at 5% of the body length the surface drag coefficients remained even lower than those of a turbulent flat plate of equal length, and with increasing Reynolds numbers they declined at a higher rate. Detailed studies on boundary layer development suggested that drag reduction resulted from the multiple curved (wavelike) outlines of the body. Due to alternating concave and convex parts, a stepwise pressure and velocity distribution was developed. Thereby, the thickness as well as the boundary layer in the turbulent velocity fluctuations within the boundary layer could be managed to keep the wall shear stress low. Hypothetically, by this mechanism, the vertical exchange of energy can be managed in a way that the boundary layer receives energy from the outer flow just sufficient to prevent flow separation.
Author
Aerodynamic Drag; Laminar Flow; Transition Flow; Axisymmetric Bodies; Turbulent Flow; Boundary Layer Control; Turbulent Boundary Layer; Boundary Layer Transition

19980020548 Istituto Nazionale di Studi Espe Architettura Navale, Italian Ship Model Basin, Rome, Italy

A Simple Model for the Aero-Hydrodynamics of Ekranoplans

Bulgarelli, U. P., Istituto Nazionale di Studi Espe Architettura Navale, Italy; Greco, M., Istituto Nazionale di Studi Espe Architettura Navale, Italy; Landrini, M., Istituto Nazionale di Studi Espe Architettura Navale, Italy; Lugni, C., Istituto Nazionale di Studi Espe Architettura Navale, Italy; High Speed Body Motion in Water; Feb. 1998; 10p; In English; Also announced as 19980020532; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The problem of a wing-shaped body moving close to the air-water interface is addressed in terms of an inviscid-rotational model in which the aerodynamic problem is coupled to the water flow by means of suitable interface conditions. A numerical procedure to solve the nonlinear unsteady problem is described. Numerical examples are given for some linearized cases. In particular the steady flow generated by a flat plate at incidence in forward motion over calm water is studied at first. The linearized wave-wing interaction is then analized in the frequency domain.

Author

Boundary Conditions; Wave Interaction; Iterative Solution; Mathematical Models; Wings; Computerized Simulation; Liquid-Vapor Interfaces

19980020549 Academy of Sciences of the Ukraine, Inst. of Hydromechanics, Kiev, Ukraine

About Movement of a Wing Above Wavy Surface of Water

Belynsky, V. G., Academy of Sciences of the Ukraine, Ukraine; Feb. 1998; 9p; In English; Also announced as 19980020532; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In the work, the outcome of an experimental research study on hydrodynamical characteristics of a wing driven above a wavy screen are represented. The description of experimental installation and techniques of realization of the experiment is given. The instantaneous significance of a lift coefficient for wings of the rectangular form in the plan, various elongations driven with various angles of attack on various distances from a flat screen and a screen, consisting of waves of sinusoidal structure of various length and height, are determined. The dependence of a lift coefficient of a wing form Strouhal number for movement above a wave screen is established. It is shown, that there is additional, not known earlier, gain of lift of a wing stipulated by the wavy form of the surface of water. The efficiency of a flap near to the screen is also discussed.

Author

Surface Water; Hydrodynamic Coefficients; Water Waves; Surface Waves; Wings

19980020805

Modelling and testing of a frictionless levitated micromotor

Williams, C. B., Univ. of Sheffield, UK; Shearwood, C.; Mellor, P. H.; Yates, R. B.; Sensors and Actuators, A: Physical; June, 1997; ISSN 0924-4247; Volume 61, no. 1-3, pp. 469-473; In English; 1996 10th EUROSENSORS Conference. Part 2 (of, Sep. 8-11, 1996, Leuven, Belgium; Copyright; Avail: Issuing Activity

This paper describes a frictionless micromotor, in which an aluminum rotor is levitated, constrained laterally and rotated by electromagnetic induction. The initial application for this motor is in a novel rotating yaw-rate sensor. The stable levitation and torque are produced by the use of high-frequency magnetic fields generated by a multi-pole stator coil. The results of analytic and finite-element modelling of the static and dynamic characteristics of the motor are presented, and the factors which affect the stability of the levitation system and the maximum speed of rotation are examined in depth, along with suggestions for further improvements. During initial testing the motor achieved angular velocities in excess of 1000 rpm, with controlled levitation heights of 5-35 micron. The motor has run for over 100 h without degradation, and because of the absence of friction excellent reliability is expected.

Author (EI)

Magnetic Induction; Electromechanical Devices; AC Generators; Electrodynamics; Stators; Rotors; Winding

19980021053

Low-cost HARMS process

Bischofberger, Roger, Neu-Technikum Buchs, Switzerland; Zimmermann, Heinrich; Staufert, Gerhard; Sensors and Actuators, A: Physical; June, 1997; ISSN 0924-4247; Volume 61, no. 1-3, pp. 392-399; In English; 1996 10th EUROSENSORS Conference. Part 2 (of, Sep. 8-11, 1996, Leuven, Belgium; Copyright; Avail: Issuing Activity

A low-cost HARMS (High Aspect Ratio MicroSystems) process has been developed, which enables the fabrication of micromechanical parts or entire systems of metal. In comparison with the original LIGA process, this process is a truly low-cost one. Based on a state-of-the-art mask technique, UV-sensitive polymer and a self-built spray processor for resist development, structures with heights of 300 micron, lateral dimension of 30 micron, sharp sidewalls and aspect ratios up to 10 can be achieved. The

developed moulds can be filled with metals (Ni, Cu) using electroforming. A proper control over some plating-bath parameters is imperative when no defects are allowed. Especially for a nickel(II)-sulfamate bath, temperature, particle filtration, periodic active carbon filtration of degenerated organics, pH measurement and monitoring of the nickel concentration are required. Monitoring the surface-active agent concentration is of great importance. Potentiometric titration using a new tenside electrode allows determination of the agent and its decomposition products. Examples of gearwheels and planar coils in photoresist and metal are given.
Author (EI)
High Aspect Ratio; Low Cost; Electromechanical Devices; Aspect Ratio; Electrolytes; Electroforming; Photolithography

19980021304 Army Research Lab., Aberdeen Proving Ground, MD USA
Transverse Electric Propagation of a Two-Dimensional Wave Traveling in a Gas Turbine Engine ***Final Report, Sep. 1996 - Aug. 1997***
Korjack, T. A., Army Research Lab., USA; Dec. 1997; 26p; In English
Report No.(s): AD-A335159; ARL-TR-1573; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two-dimensional transverse electric (TE) electromagnetic scattering of a sine source disturbance was numerically solved using the finite difference-time domain (FD-TD) method with the inclusion of the Mur absorbing boundary conditions. The imposition of the appropriate boundary conditions appears to be effective for absorption of dispersive, multimodal, and even evanescent energy. The absorption as used in this study is thought at best to be in order of the analytical absorbing boundary condition because of increasing reflection at oblique incident angles. The solution presented demonstrates the efficient use of the second approximation of the Mur boundary condition since the mesh was simple, incorporation of the TE equations quite straightforward, and application of the boundary stipulations continuously dependent upon the data. This method development and subsequent solution does show that a radiative point source in a two-dimensional mesh can simulate an electromagnetic disturbance occurring from a region in a gas turbine engine, along with its attendant wave distribution and pattern with intensity magnitudes that help demonstrate bow an excitation can possibly affect an electromagnetic device in its operational voltage surges.
DTIC
Boundary Conditions; Electromagnetic Scattering; Electric Potential; Finite Difference Theory; Gas Turbine Engines; Point Sources

19980021318 Research Triangle Inst., Center for Aerospace Technology, Hampton, VA USA
Three-Centimeter Doppler Radar Observations of Wingtip-Generated Wake Vortices in Clear Air
Marshall, Robert E., Research Triangle Inst., USA; Mudukutore, Ashok, Research Triangle Inst., USA; Wissel, Vicki L. H., Research Triangle Inst., USA; Myers, Theodore, Virginia Polytechnic Inst. and State Univ., USA; Dec. 1997; 88p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS1-18925; RTOP 538-04-11-15
Report No.(s): NASA/CR-97-206260; NAS 1.26:206260; RTI/4500/055-01F; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report documents a high risk, high pay-off experiment with the objective of detecting, for the first time, the presence of aircraft wake vortices in clear air using X-band Doppler radar. Field experiments were conducted in January 1995 at the Wallops Flight Facility (WFF) to demonstrate the capability of the 9.33 GHz (I=3 cm) radar, which was assembled using an existing nine-meter parabolic antenna reflector at VVTT and the receiver/transmitter from the NASA Airborne Windshear Radar-Program. A C-130-aircraft, equipped with wingtip smoke generators, created visually marked wake vortices, which were recorded by video cameras. A C-band radar also observed the wake vortices during detection attempts with the X-band radar. Rawinsonde data was used to calculate vertical soundings of wake vortex decay time, cross aircraft bearing wind speed, and water vapor mixing ratio for aircraft passes over the radar measurement range. This experiment was a pathfinder in predicting, in real time, the location and persistence of C-130 vortices, and in setting the flight path of the aircraft to optimize X-band radar measurement of the wake vortex core in real time. This experiment was conducted in support of the NASA Aircraft Vortex Spacing System (AVOSS).
Author
Vortices; Doppler Radar; Aircraft Wakes; Airborne Radar; Mixing Ratios; Radar Tracking; Wing Tips

19980021505
Influence of injectant Mach number and temperature on supersonic film cooling
Juhany, K. A., California Inst. of Technology, Pasadena, USA; Hunt, M. L., California Inst. of Technology, Pasadena; Sivo, J. M., California Inst. of Technology, Pasadena; Journal of Thermophysics and Heat Transfer; Mar. 1994; ISSN 0887-8722; Volume 8, no. 1, pp. 59-67; In English; Copyright; Avail: Aeroplus Dispatch

The current work is an experimental investigation of the dependence of film cooling effectiveness on the injection Mach number, velocity, and mass flux. The freestream Mach number is 2.4, and the injection Mach numbers range from 1.2 to 2.2 for both air and helium injection. The total temperature of the freestream is 295 K and for the injection it ranges from 215-390 K. The results indicate an increase in film cooling effectiveness as the injection rate is increased. With the exception of heated helium runs, larger injection Mach numbers slightly increase the effective cooling length per mass injection rate. The results for helium injection indicate an increase in effectiveness as compared to that for air injection. Heated injection, with the injectant to freestream velocity ratios greater than 1, exhibit a rise in wall temperature downstream of the slot resulting in effectiveness values greater than 1. The experimental results are also compared with earlier studies in the literature.
Author (AIAA)
Fluid Injection; Mach Number; Film Cooling; Temperature Control; Supersonic Flight

19980021570

Study on hysteresis behavior of turbo-alternator end bells

Okamoto, Noriaki; Nippon Kikai Gakkai Ronbunshu, A Hen/Transactions of the Japan Society of Mechanical Engineers, Part A; March, 1997; ISSN 0387-5008; Volume 63, no. 607, pp. 618-623; In Japanese; Copyright; Avail: Issuing Activity

The end-bells of a turbo alternator consist of an end-bell and a supporting ring. Their purpose is to hold together the coil ends emerging from the rotor body and to prevent them from shifting. During operation, and end-bell tends to spread outward due to centrifugal forces, and then slip or play develops at the seating. Furthermore, as the speed decreases, sticking occurs there. We discuss the contact mechanics of end-bell hysteresis behavior. First, it is shown experimentally that micro-slip can occur on shrink-fit surfaces during load cycles. Next, this contact behavior and micro slip are investigated using a 3-dimensional FEM. The numerical predictions of hysteresis-behavior agree well with experimental results. The stick-slip thresholds are functions of design parameters such as interference fit and friction coefficient. This technique can be used to improve the balance design of the rotors.
Author (EI)
AC Generators; Interference Fit; Electric Generators; Hysteresis; Rotors

19980022381

A micromechanical creep analysis of a turbine rotor

Dib, Michel W., Texas Univ., Austin, USA; Rodin, Gregory J., Texas Univ., Austin; 1992, pp. 1-12; In English; Copyright; Avail: Aeroplus Dispatch

The creep life of a currently operating turbine rotor is analyzed using a recently proposed model for creep brittle materials. A summary of the governing equations of the model is provided, and it is shown how they can be implemented into a finite element model. Results of heat conduction and stress analyses are presented. The creep life of the turbine rotor, made of a material comparable to German DIN-17Mo-V84 steel, is estimated at 380 yr. It is noted that the model is valid only for creep brittle materials and therefore should be used only for structures undergoing creep under relatively low stress and moderate homologous temperatures.
AIAA
Micromechanics; Creep Analysis; Rotors; Stress-Strain-Time Relations; Creep Diagrams

19980022409

Assessment of penetrant and eddy current methods for the detection of small cracks

Lord, Robert J., McDonnell Douglas Aerospace, USA; Materials Evaluation; Oct. 1993; ISSN 0025-5327; Volume 51, no. 10, pp. 1090, 1092-1094; In English; Copyright; Avail: Aeroplus Dispatch

Results of a program aimed at evaluating the penetrant and eddy current methods for the detection of 0.015 x 0.015 in. corner cracks in fuel transfer holes in F-15E wing spars are summarized. A 90 percent probability of detection at 95 percent confidence level was achieved by both methods for 0.015 x 0.015 in. hole corner cracks. The penetrant method was selected over the eddy current method for the in-service inspection of wing spars because of its simplicity and higher reliability in detecting very small cracks.
AIAA
Microcracks; Nondestructive Tests; Damage Assessment; Inspection; Aircraft Maintenance

19980022418

Evolution of probabilistic life analysis for flight propulsion structures

Annis, Charles, Pratt & Whitney Group, USA; 1992, pp. 245-253; In English; Copyright; Avail: Aeroplus Dispatch

On the surface probabilistic life analysis (PLA) appears simple and straightforward: the probability of structural failure is simply the probability that demand will exceed capability - that stress will exceed strength, for example. In practice PLA is consid-

erably more involved. Aerospace structures are frequently vulnerable to a multiplicity of potential failure modes. The long-standing engineering practice of designing to a worst-case condition is often impossible because operating stresses, temperatures, and their gradients have conflicting influences on competing failure modes. This paper considers the evolution of PLA from an historical perspective. The increasing demands placed on flight propulsion structures motivate the need for PLA and its recent inclusion as part of the structural design process. This leads to an investigation of the disparate origins of the method in both statistics and mechanics, and culminates with a discussion of current issues in assessing component structural longevity and reliability.
Author (AIAA)
Probability Theory; Flight Vehicles; Propulsion System Performance; Failure Modes; Structural Design

19980022491

Cumulative sonic boom damage to plaster

Haber, J. M., Acta, Inc., USA; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4446; Copyright; Avail: Aeroplus Dispatch

Full-scale plaster walls including fixturing to simulate the resistance of the ceiling, roof, and sidewalls to the motion of the wall were tested in a sonic boom simulator chamber. A sophisticated imaging system was used to compare the condition of the plaster surface at successive inspection points. This provided an increased level of consistency and sensitivity to the process of damage detection. A statistically significant fatigue damage relationship was derived to represent the most severe damage observed. Statistically significant relationships between the extent of damage and the number of booms were established for other damage domains as well. The damage levels for other domains, however, were proportional to the number of booms to a power less than one. Thus, they did not show an increasing damage rate with number of booms. The type of damage that occurs depends on the sonic boom loads, preexisting stresses in the plaster, and preexisting damage to the plaster.
Author (AIAA)
Sonic Booms; Cumulative Damage; Structural Failure; Damage Assessment; Imaging Techniques

19980022516

Aeroelastic stability of hingeless, elastically tailored rotor blades in hover

Fulton, Mark V., Georgia Inst. of Technology, Atlanta, USA; Hodges, Dewey H., Georgia Inst. of Technology, Atlanta; 1992, pp. 9-23; In English

Contract(s)/Grant(s): DAAL03-89-K-0007; Copyright; Avail: Aeroplus Dispatch

A finite element based stability analysis is developed for a hingeless, composite, isolated rotor in hover. It includes a mechanism for the inclusion of a complete 6 x 6 stiffness matrix, as well as the effects of rotary inertia. No restrictions are made on the magnitudes of the displacements and rotations if the magnitudes of the strains remain small compared to unity. The equilibrium position is obtained by an iterative solution of the complete nonlinear equations. The lift model is a 2D, quasi-steady strip theory, with inflow taken from momentum theory. Stability results are generated for both extension-twist and bending-twist coupled rotor blades. Results indicate that inclusion of ’nonclassical’ couplings is important for some cases.
Author (AIAA)
Rigid Rotors; Tail Rotors; Aeroelasticity; Rotor Blades; Hovering; Dynamic Structural Analysis

19980022528

Structural dynamic model of composite rotor blades undergoing moderate deflections

Yuan, K. A., California Univ., Los Angeles, USA; Venkatesan, C., California Univ., Los Angeles; Friedmann, P. P., California Univ., Los Angeles; 1992, pp. 127-155; In English

Contract(s)/Grant(s): NAG1-833; Copyright; Avail: Aeroplus Dispatch

This paper presents a concise description of a structural dynamic model for composite rotor blades, with straight and swept tips, undergoing moderate deflections. The model can represent anisotropic rotor blades, with arbitrary cross sections and is valid for the moderate amount of built-in twist encountered in helicopter rotor blades. The results illustrate the effects of composite ply orientation and tip sweep on the natural frequencies of composite blades. The paper also presents some interesting observations on the treatment of the axial DOF, which plays an important role in the structural dynamic modeling of composite rotor blades.
Author (AIAA)
Rotor Blades; Dynamic Structural Analysis; Composite Structures; Rigid Rotors

19980022529

Structural modeling of composite beams with induced strain actuators

Chandra, Ramesh, Maryland Univ., College Park, USA; Chopra, Inderjit, Maryland Univ., College Park; 1992, pp. 99-125; In English

Contract(s)/Grant(s): DAAL03-88-C-0022; Copyright; Avail: Aeroplus Dispatch

This paper presents an analytical-cum-experimental investigation on structural modeling of coupled composite beams with distributed induced strain actuators. Analysis based on Vlasov theory is developed to include distributed piezoelectric actuators, either surface mounted or embedded. In order to evaluate the analytical predictions, several bending-torsion and extension-torsion coupled graphite-epoxy solid beams were fabricated using an autoclave molding technique. These were surface mounted with piezoelectric actuators. The actuators were excited to produce local bending moments and axial force on the beam, and the structural response was measured in terms of bending slope, induced twist and surface strain. Good correlation between analysis and experiment was achieved. Due to the existence of the chordwise actuator moment, the twisting of bending-torsion coupled beams was significantly influenced by including the chordwise curvature of the plate segment of the beam in the formulation. For (45)24 solid beams, the chordwise bending of the plate segment of beam was found to increase the tip twist by about 100 percent.

Author (revised by AIAA)

Beams (Supports); Composite Structures; Actuators; Combined Stress; Smart Structures; Rotary Wings

19980022808

Application of H(sub INF) robust control to the RM12 jet engine

Harefors, M., Volvo Aero Corp., Sweden; Control Engineering Practice; September, 1997; ISSN 0967-0661; Volume 5, no. 9, pp. 1189-1201; In English; Copyright; Avail: Issuing Activity

Turbojet engines are becoming increasingly complex, with more control variables, to meet future demands on performance, fuel consumption and functionality. to utilize the potential of the engines, it is also necessary to use more advanced control concepts than are conventionally used today. The trend is towards control concepts often referred to as ’Smart Engines’. Multivariable controllers are most often the core of these systems. A multivariable control concept for a jet engine is proposed and investigated in this paper. The feedback control law is based on H(sub infinity)-design. The control concept is applied to the RM12 jet engine for the Swedish fighter aircraft JAS 39 Gripen in a research program for future advanced control. The controller has so far been developed for the core engine operating range, at sea-level static conditions, and evaluated via simulation with a detailed non-linear model. This evaluation clearly shows the potential of using more advanced control methods in the area of jet engine control. Finally, suggestions on how to continue the research program towards a future advanced control concept are given.

Author (EI)

Jet Control; Jet Engines; Multivariable Control; Robustness (Mathematics); Gas Turbines; Aerospace Engineering

19980022853

Experimental investigation of a single-side slope-slotted atomizer

Qu, Benquan, CAAC Flight College, China; Journal of Aerospace Power; Oct. 1993; ISSN 1000-8055; Volume 8, no. 4, pp. 399-402; In Chinese; Copyright; Avail: Aeroplus Dispatch

A single-side slope-slotted atomizer has been constructed for single-side atomization. An experimental investigation has been carried out on the flow pattern and flow resistance of this atomizer. Its low total pressure loss is demonstrated. Information on its atomization field has been obtained, from which its atomization characteristics and its fuel atomization density distribution are derived. It is shown that this atomizer is well suited for an afterburner of a turbofan aeroengine.

Author (revised by AIAA)

Atomizers; Flow Distribution; Flow Resistance; Fuel Sprays; Aircraft Engines

19980022866

Integration of design and manufacture of centrifugal compressors

Jiu, Jianfeng, Chinese Academy of Sciences, Inst. of Engineering Thermophysics, China; Cao, Xiaojin, Chinese Academy of Sciences, Inst. of Engineering Thermophysics, China; Journal of Aerospace Power; Oct. 1993; ISSN 1000-8055; Volume 8, no. 4, pp. 406-408; In Chinese; Copyright; Avail: Aeroplus Dispatch

A system for integrating the design and manufacture of centrifugal compressors using CAD/CAM is established which includes blade design, machining coordinates transformation, blade profiling in an arbitrary section, and checking coordinate calculation. In particular, a set of design and calculation methods is provided for manufacturing turbomachines by four-axis numerically controlled machining. The integration system can be used on a microcomputer. The system has been applied successfully

to designing and machining centrifugal compressors in a factory. It is proven that the system is practical, flexible, reliable, and can cut down the time of design and manufacture while providing high quality.
Author (revised by AIAA)
Centrifugal Compressors; Systems Integration; Computer Aided Design; Compressor Blades

19980022942

Air Force perspective on probabilistic design

Thomson, Daniel E., USAF, Turbine Engine Div., USA; Fecke, Theodore G., USAF, Turbine Engine Div., USA; 1992, pp. 25-32; In English; Copyright; Avail: Aeroplus Dispatch

It is a primary goal of the USA Air Force to ensure the structural integrity of any aircraft's flight critical components. There have been many advances in gas turbine engine component technology, often leading to a similar increase in component life prediction capability. This paper is intended to show how new technologies and current Air Force gas turbine engine goals are creating the need for another advance in life prediction capability. The new approach will need to make full use of the known statistical distribution of all necessary parameters, and combine them to produce a statistical prediction of the desired result. This approach, known as probabilistic design, will be a key part in the design and qualification of all future gas turbine engines.
Author (AIAA)
Aircraft Engines; Probability Theory; Engine Design; Gas Turbine Engines; Engine Parts

19980022952

Reliability of stiffened structural panels - Two examples

Stroud, W. J., NASA Langley Research Center, USA; Davis, D. D., Jr., NASA Langley Research Center, USA; Maring, Lise D., Lockheed Engineering and Sciences Co., USA; Krishnamurthy, Thiagaraja, Analytical Services and Materials, Inc., USA; Elishakoff, Isaac, Florida Atlantic Univ., Boca Raton; 1992, pp. 199-216; In English
Contract(s)/Grant(s): RTOP 505-63-53-01; Copyright; Avail: Aeroplus Dispatch

The reliability of two graphite-epoxy stiffened panels that contain uncertainties is examined. For one panel, the effect of an overall bow-type initial imperfection is studied. The size of the bow is assumed to be a random variable. The failure mode is buckling. The benefits of quality control are explored by using truncated distributions. For the other panel, the effect of uncertainties in a strain-based failure criterion is studied. The allowable strains are assumed to be random variables. A geometrically nonlinear analysis is used to calculate a detailed strain distribution near an elliptical access hole in a wing panel that was tested to failure. Calculated strains are used to predict failure. Results are compared with the experimental failure load of the panel.
Author (AIAA)
Buckling; Composite Structures; Failure Analysis; Graphite-Epoxy Composites; Holes (Mechanics); Prediction Analysis Techniques; Strain Distribution; Structural Failure; Structural Reliability; Wing Panels

19980022956

Probabilistic crack growth analysis for airframe applications

Pawlik, M., McDonnell Aircraft Co., USA; Perez, R., McDonnell Aircraft Co., USA; Register, D., Warner-Robins ALC, USA; 1992, pp. 113-125; In English; Copyright; Avail: Aeroplus Dispatch

The probabilistic fatigue crack growth analysis procedure described in this paper accounts for variation in fracture toughness, yield strength, crack growth rate vs. stress intensity, and applied stress level. This procedure uses a crack extension algorithm numerous times, using many combinations of input variables in order to determine the scatter in crack growth life. Examples are included to illustrate the application of the methods.
Author (AIAA)
Airframes; Crack Propagation; Probability Theory; Fatigue Life; Yield Strength

19980022957

Probabilistic damage tolerant analyses for fatigue critical aircraft components

Kurth, Robert E., Science Applications International Corp., Advanced Technology Div., USA; Woods, Karon S., NASA Johnson Space Center, USA; 1992, pp. 89-97; In English; Copyright; Avail: Aeroplus Dispatch

Probabilistic modeling of the damage accumulation process has been applied to the Shuttle Training Aircraft (STA). This model has been placed in a Damage Tolerant Analysis (DTA) framework. The need for DTA arises because of the non-standard flight profiles that are required of the STA. The analyses performed to date have been on the joint of the wing rear beam lower cap angle where the wing sweep changes. The results indicated that this component of the aircraft is damage tolerant with a high

degree of confidence. In addition, current NASA inspection intervals insure that the aircraft component will remain damage tolerant. The expected probability of the structural strength falling below fail safe limits is less than 1 in 10,000,000.
Author (AIAA)
Aircraft Structures; Cumulative Damage; Training Aircraft; Fatigue Life; Tolerances (Mechanics)

13
GEOSCIENCES

Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

19980022890
Modeling the sonic boom noise environment in military operating areas
Frampton, Kenneth D., Wyle Labs., USA; Lucas, Michael J., Wyle Labs., USA; Cook, Brenda W., USAF, USA; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4432; Copyright; Avail: Aeroplus Dispatch

The USAF Air Combat Maneuver training arena has been subjected to a sonic boom measurement program, in order to validate current noise-modeling and prediction methods. Further validation has thus been obtained for a generic equation defining the elliptic contours of day-night C-weighted levels associated with supersonic operations. The ellipse is found to be not only a function of the number of operations, but also of the available airspace boundaries.
AIAA
Sonic Booms; Noise Measurement; Noise Prediction; Military Air Facilities; Noise Pollution

14
LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and space biology.

19980020628 Army Command and General Staff Coll., Fort Leavenworth, KS USA
AH-64D Longbow Helicopter Gunnery Training Strategy
Williams, John D., Army Command and General Staff Coll., USA; Jun. 06, 1997; 124p; In English
Report No.(s): AD-A331808; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This thesis in an assessment of attack helicopter gunnery training and the adequacy of that training as the Army fields the AH-64D Longbow attack helicopter starting in 1997. The problem confronted by this study is both institutional and unit gunnery training. This thesis is supported by an overview of the current helicopter gunnery training strategy and contains a history of the development of the attack helicopter, as well as the expectations of Aviation Branch in Force XXI. Finally, a comparison of capabilities is conducted between the AH-64A and the AH-64D. The thesis draws several conclusions. First, the current helicopter gunnery training strategy is not acceptable for the Longbow. Second, the gunnery infrastructure is insufficient to assist commanders, analyze trends, and incorporate lessons learned. Third, the training aids and simulators available to the Longbow unit commander will likely be inadequate. The majority of the analysis in this thesis focuses on the human dimension of attack helicopter employment. Army aviators will continue to employ helicopters in combat through the foreseeable future; therefore, training should focus on preparing them for that combat and the uncertainty that will confront them. by focusing on technology, the importance of human strengths and weaknesses may be overlooked.
DTIC
Aircraft Pilots; Helicopters; Training Simulators; Training Devices

19980021233 Metrica, Inc., San Antonio, TX USA
Evaluating the Decision-Making Skills of General Aviation Pilots ***Final Report***
Driskill, W. E., Metrica, Inc., USA; Weissmuller, Johnny J., Metrica, Inc., USA; Quebe, John C., Metrica, Inc., USA; Hand, Darryl K., Metrica, Inc., USA; Hunter, David R., Federal Aviation Administration, USA; Feb. 1998; 52p; In English
Report No.(s): DOT/FAA/AM-98/7; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

An instrument consisting of 51 items was developed to assess pilot decision-making skill. Each item consisted of a stem, a short description of an aviation scenario requiring a decision on the part of the pilot. Four alternatives were provided, and subjects were instructed to rank order the alternatives from best to worst solution to the scenario presented. Rank-ordered judgments of

a sample of 246 general aviation (GA) pilots (with an average of about 500 hours of total flying experience) were compared with the recommended solutions provided by an expert panel. Results indicated that, overall, GA pilots and an expert panel of pilots agreed in their judgments of the appropriate course of action in situations critical to flight safety. However, the degree of agreement of individual general aviation pilots with the recommended solutions varied widely. An index of agreement (Safety Deviation Index) was calculated that expressed the degree of agreement of individual GA pilots with the recommended solutions. Initial evaluation of this index indicates that it demonstrates adequate psychometric properties and that, as other research would suggest, it has little relationship with common demographic or flight experience measures.
Author
Decision Making; Flight Safety; Psychometrics; Judgments; General Aviation Aircraft

19980021382 Ohio State Univ., Columbus, OH USA
An Evaluation of Pilot Acceptance of the Personal Minimums Training Program for Risk Management ***Final Report***
Jensen, Richard S., Ohio State Univ., USA; Guilkey, James E., Ohio State Univ., USA; Hunter, David R., Federal Aviation Administration, USA; Feb. 1998; 30p; In English
Contract(s)/Grant(s): DTFA01-92-10204; Proj. AM-A-94-189
Report No.(s): DOT/FAA/AM-98/6; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A new general aviation training program entitled, ”Personal Minimums for Aviator Risk Management in Pre-Take-off Decisions” was field tested in five diverse geographic locations around the USA (Columbus, OH; Long Beach, CA; Anchorage, AL; Baltimore, MD/Washington, DC; and Chicago, IL) to determine its acceptability to pilot audiences and to obtain feedback for further development of the intervention. In each case, following the presentation, participants were asked to evaluate the course and its acceptability to the general aviation community. Analysis of these evaluations revealed that respondents viewed the training program as helpful and intended to use personal minimums as part of their pre-flight decision making in the future. Respondent comments and feedback from local FAA personnel at each of the field sites resulted in progressive modifications to the training format and presentation to improve its acceptance and utility throughout the course of the field test. It is recommended that development proceed with video and computer-based versions of this training program and that studies of the training impact be conducted, possibly in concert with the dissemination of the program throughout the FAA safety seminar program.
Author
Project Management; Decision Making; Computer Techniques; Safety; Education; General Aviation Aircraft

19980021435
Enhancement of anti-G effect of L-1 maneuvering by strengthening of respiratory muscles in pilots
Wang, Shan-xiang, Chinese Air Force, China; Zhing, Jian-yin, Chinese Air Force, China; Geng, Xi-chen, Chinese Air Force, China; Chinese Journal of Aviation Medicine; Jun. 1993; ISSN 1001-6589; Volume 4, no. 2, pp. 90-92; In Chinese; Copyright; Avail: Aeroplus Dispatch

The purpose of the present study was to look for a convenient, effective method to increase the anti-G effect of L-maneuvering. Thirty pilots underwent a three-week program of respiratory muscle strengthening exercise during their regular convalescence in sanatorium. The training achieved a 40.6 percent increase in maximal expiratory pressure (MEP) and 27.0 percent increase in maximal inspiratory pressure (MIP) at mouth, 132.6 percent increase in expiratory tolerance time and 137.8 percent increase in inspiratory tolerance time. L-1 maneuvering showed an increase of G tolerance by of 0.35 G and prolongation of sustained performance of L-1 maneuver by 80.8 s. The results indicated that the strengthening of respiratory muscles could enhance the anti-G effect of L-1 maneuvering obviously. Our program of respiratory muscle strengthening exercise may be included into the aviation physiology training of pilots during their regular convalescence in sanitorium.
Author (revised by AIAA)
Muscular Function; Respiratory System; Aircraft Maneuvers; Acceleration Tolerance; Acceleration Protection

19980021832
Conditional logistic regression analysis of the personality traits in pilots with neurasthenia
Dong, Yan, Chinese Air Force, China; Miao, Dan-min, Chinese Air Force, China; Mai, Shuang-hou, Chinese Air Force, China; Chinese Journal of Aviation Medicine; Sep. 1993; ISSN 1001-6589; Volume 4, no. 3, pp. 154-156; In Chinese; Copyright; Avail: Aeroplus Dispatch

The methods of the unifactor analysis and the multiple factor conditional logistic regression analysis were applied to investigate personality traits in 52 pilots with neurasthenia and 49 healthy pilots as controls. The results indicate that the method of multiple factor conditional logistic regression analysis is the method of choice to make the principal personality traits stand out discriminating the patients from the controls, while the personality traits were relatively dispersed in unifactor analysis. The study

also showed that the neurasthenic pilots have a special personality characteristic, and a discussion of the relation between the characteristic traits and neurasthenic patients follows.
Author (revised by AIAA)
Aircraft Pilots; Personality; Pilot Selection; Aviation Psychology; Neurasthenia

15
MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

19980022505

Identification of system, observer, and controller from closed-loop experimental data

Juang, Jer-Nan, NASA Langley Research Center, USA; Phan, Minh, NASA Langley Research Center, USA; Journal of Guidance, Control, and Dynamics; Feb. 1994; ISSN 0731-5090; Volume 17, no. 1, pp. 91-96; In English; Copyright; Avail: Aeroplus Dispatch

No abstract available.

Controllers; Feedback Control; System Identification; Wind Tunnel Tests; Flutter Analysis; Flexible Wings

19980022706 Stottler Henke Associates, Inc., San Mateo, CA USA

A Case-Based Reasoning Approach to Operator Assessment and Operator Machine Interface Enhancement, Phase 1 ***Final Report, 20 Feb. - 20 Dec. 1997***

Stottler, Richard, Stottler Henke Associates, Inc., USA; Davis, Alexander, Stottler Henke Associates, Inc., USA; Jan. 02, 1998; 39p; In English
Contract(s)/Grant(s): N00421-97-C-1134
Report No.(s): AD-A334196; OMIA-145-Phase-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In Phase 1 we investigated a case-based reasoning (CBR) approach to Operator Assessment and Operator Machine Interface Enhancement for the LAMPS SH-60R Multi Mission Helicopter Upgrade (MMHU). We Developed a limited prototype case-based Operator Assessment and Operator Machine Interface Enhancement System (OA/OMIES), for the SH-60R sensor operator for a small subset of ASW situations. We developed a generic OA/OMIES architecture applicable in many other domains . The OA/OMIES tests operator knowledge through the use of tactical scenarios, derives the operators mental model based on his deficiencies revealed in the mental model. The prototype implementation provided and absolute proof by example of the feasibility of our ideas. The case-based approach offers the further benefits of automatically of semi-automatically generating the operators mental model and of the largely circumventing the difficult and time consuming process of constructing and explicit expert mental model. Our approach could be easily extended to constitute and Intelligent Tutoring System (ITS) for the SH-60R as well.
DTIC
Helicopters; Luminaires; Man Machine Systems; Artificial Intelligence

19980022859

Application of fuzzy control theory to designing an adaptive device

Luo, Enke, Northwestern Polytechnical Univ., China; Wu, Qihua, Northwestern Polytechnical Univ., China; Journal of Aerospace Power; Oct. 1993; ISSN 1000-8055; Volume 8, no. 4, pp. 371-374; In Chinese; Copyright; Avail: Aeroplus Dispatch

A new design approach is proposed according to fuzzy control theory. It is applied to the design of proportional and integral adaptive control devices for the digital adaptive speed control system of a two-spool turbojet. Two methods (phase-plane method and membership degree method) have been used in this design. The digital simulation of the whole system has been completed. Its results demonstrate that this new approach combines the advantages of proportional, integral and fuzzy controls. It simplifies the control algorithm and enhances the control accuracy. Finally, the new design approach is suitable for nonlinear and high-order plants that lack a precision mathematical model.
Author (revised by AIAA)
Fuzzy Sets; Control Theory; Adaptive Control; Control Systems Design; Turbojet Engines

19980022860

Real-time simulation of a two-spool turbojet by parallel processing

Zeng, Qinfu, Northwestern Polytechnical Univ., China; Zhanf, Yandong, Northwestern Polytechnical Univ., China; Guan, Yanshen, Northwestern Polytechnical Univ., China; Journal of Aerospace Power; Oct. 1993; ISSN 1000-8055; Volume 8, no. 4, pp. 368-370; In Chinese; Copyright; Avail: Aeroplus Dispatch

A real-time simulator of a two-spool turbojet is introduced, which is implemented with a parallel-processor/microcomputer system. A PC 286 microcomputer is used as the host computer, and four TMS32020 digital signal processors are chosen as processing units of the parallel system. The A/D and D/A boards serve as the interfaces of the hardware-in-the-loop simulation of the engine control system. For the parallel processing, it is necessary to partition the aerothermodynamic model of the two-spool turbojet. The elements of the Jacobian matrix in the Newton-Raphson iterative method are calculated parallelly in the four processing units. The real-time engine simulator has been applied to a hardware-in-the-loop simulation for an engine digital control system. The simulation frame cycle time is 29.6 milliseconds.

Author (revised by AIAA)

Turbojet Engines; Computerized Simulation; Parallel Processing (Computers); Engine Control

19980022927

Control surface failure detection and accommodation using neuro-controllers

KrishnaKumar, K., Alabama Univ., Tuscaloosa, USA; Lattus, R., Jr., Alabama Univ., Tuscaloosa; Oct. 1993; In English

Contract(s)/Grant(s): NSF ECS-91-13283

Report No.(s): AIAA Paper 93-4614; Copyright; Avail: Aeroplus Dispatch

The ability of neural networks to learn from repeated exposure to system characteristics has made them a popular choice for many applications in linear and nonlinear control. In this paper, the capabilities of neural networks in detecting and accommodating control surface failures for a modified F/A-18 'supermaneuverable' fighter aircraft are examined. to detect and accommodate a failure in the thrust vectoring vane during a pitch maneuver, a hierarchical neurocontroller is designed using thrust vectoring, symmetric leading edge flap, and the throttle. This neurocontroller is then used as the fault-accommodating neurocontroller. A separate neural network is trained to detect failures in the thrust vectoring vane. Performance of the controller and fault-detection networks are verified using a numerical simulation of a longitudinal model of the aircraft.

Author (AIAA)

Control Surfaces; Failure Analysis; Neural Nets; F-18 Aircraft; Digital Simulation; Aircraft Models

16
PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

19980019275 Minnesota Univ., Minneapolis, MN USA

Development of Improved Surface Integral Methods for Jet Aeroacoustic Predictions ***Final Report***

Pilon, Anthony R., Minnesota Univ., USA; Lyrintzis, Anastasios S., Purdue Univ., USA; Jun. 1997; 122p; In English

Contract(s)/Grant(s): NAG1-1660; NSF ASC-95-0019P

Report No.(s): NASA/CR-97-207181; NAS 1.26:207181; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The accurate prediction of aerodynamically generated noise has become an important goal over the past decade. Aeroacoustics must now be an integral part of the aircraft design process. The direct calculation of aerodynamically generated noise with CFD-like algorithms is plausible. However, large computer time and memory requirements often make these predictions impractical. It is therefore necessary to separate the aeroacoustics problem into two parts, one in which aerodynamic sound sources are determined, and another in which the propagating sound is calculated. This idea is applied in acoustic analogy methods. However, in the acoustic analogy, the determination of far-field sound requires the solution of a volume integral. This volume integration again leads to impractical computer requirements. An alternative to the volume integrations can be found in the Kirchhoff method. In this method, Green's theorem for the linear wave equation is used to determine sound propagation based on quantities on a surface surrounding the source region. The change from volume to surface integrals represents a tremendous savings in the computer resources required for an accurate prediction. This work is concerned with the development of enhancements of the Kirchhoff method for use in a wide variety of aeroacoustics problems. This enhanced method, the modified Kirchhoff method, is shown to be a Green's function solution of Lighthill's equation. It is also shown rigorously to be identical to the methods of Ffowcs Williams and Hawkings. This allows for development of versatile computer codes which can easily alternate between the different

Kirchhoff and Ffowcs Williams-Hawkings formulations, using the most appropriate method for the problem at hand. The modified Kirchhoff method is developed primarily for use in jet aeroacoustics predictions. Applications of the method are shown for two dimensional and three dimensional jet flows. Additionally, the enhancements are generalized so that they may be used in any aeroacoustics problem.
Author
Aeroacoustics; Noise Prediction; Aerodynamic Noise; Algorithms; Computational Fluid Dynamics; Sound Propagation; Computer Programs; Jet Aircraft Noise

19980021469

Unstructured adaptive mesh computations of rotorcraft high-speed impulsive noise

Strawn, Roger, NASA Ames Research Center, USA; Garceau, Michael, Stanford Univ., USA; Biswas, Rupak, NASA Ames Research Center, USA; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4359; Copyright; Avail: Aeroplus Dispatch

A new method is developed for modeling helicopter high-speed impulsive (HSI) noise. The aerodynamics and acoustics near the rotor blade tip are computed by solving the Euler equations on an unstructured grid. A stationary Kirchhoff surface integral is then used to propagate these acoustic signals to the far field. The near-field Euler solver uses a solution-adaptive grid scheme to improve the resolution of the acoustic signal. Grid points are locally added and/or deleted from the mesh at each adaptive step. An important part of this procedure is the choice of an appropriate error indicator. The error indicator is computed from the flow-field solution and determines the regions for mesh coarsening and refinement. Computed results for HSI noise compare favorably with experimental data for three different hovering rotor cases.
Author (AIAA)
Grid Generation (Mathematics); Helicopters; High Speed; Aeroacoustics; Noise Reduction; Supersonic Flow

19980021485

Matching of near/far-field equations sets for direct computation of aerodynamic sound

Freund, Jonathan B., Stanford Univ., USA; Lele, Sanjiva K., Stanford Univ., USA; Moin, Parviz, Stanford Univ., USA; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4326; Copyright; Avail: Aeroplus Dispatch

Methods to reduce the cost of direct computations of aerodynamic sound generation are investigated. Direct numerical simulation offers a valuable means of testing the validity and applicability of aeroacoustic theories. However, computations at low Mach number tend to become expensive because solvers must be highly accurate to resolve small acoustic energies within a flow field and domains must be large enough to encompass both the small length scale of the acoustic source and the large length scale of the sound. The present work reduces this expense with a domain decomposition. The compressible Navier-Stokes equations are solved in the source region, and simplified equations are solved in the acoustic region. A convecting wave equation and the isentropic linearized Euler equations are accurately matched to the Navier-Stokes solver beyond the source region to solve the radiated acoustic field. Effects of variable grid spacings are examined. Sample calculations are given, and the accuracy of the method is evaluated.
Author (AIAA)
Aerodynamic Noise; Near Fields; Far Fields; Digital Simulation; Aeroacoustics; Euler Equations of Motion

19980021486

Direct computation of nonlinear acoustic pulses using high-order finite difference schemes

Tam, Christopher K. W., Florida State Univ., Tallahassee, USA; Shen, Hao, Florida State Univ., Tallahassee; Oct. 1993; In English
Contract(s)/Grant(s): NAG3-1267
Report No.(s): AIAA Paper 93-4325; Copyright; Avail: Aeroplus Dispatch

An evaluation is conducted of the feasibility of a high-order finite difference scheme's (HOFDS) use in computing linear and nonlinear acoustic pulse solutions. Attention is given to the spurious oscillations generated by HOFDSs in regions of steep gradients and shocks. It is found that the dominant wavelengths at which these oscillations originate are concentrated within a narrow band in the short-wave range of the HOFDS. Results are reported for extensive numerical experiments on nonlinear acoustic-pulse propagation, using artificial selective damping.
AIAA
Finite Difference Theory; Aeroacoustics; Nonlinear Equations; Aircraft Noise; Acoustic Propagation

19980021488

Mixing noise reduction for rectangular supersonic jets by nozzle shaping and induced screech mixing

Rice, Edward J., NASA Lewis Research Center, USA; Raman, Ganesh, Sverdrup Technology, Inc., USA; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4322; Copyright; Avail: Aeroplus Dispatch

Two methods of mixing noise modification were studied for supersonic jets flowing from rectangular nozzles with an aspect ratio of about five and a small dimension of about 1.4 cm. The first involves nozzle geometry variation using either single (unsymmetrical) or double bevelled (symmetrical) thirty degree cutbacks of the nozzle exit. Both converging (C) and converging-diverging (C-D) versions were tested. The double bevelled C-D nozzle produced a jet mixing noise reduction of about 4 dB compared to a standard rectangular C-D nozzle. In addition all bevelled nozzles produced an upstream shift in peak mixing noise which is conducive to improved attenuation when the nozzle is used in an acoustically treated duct. The second approach uses paddles inserted on the edge of the two sides of the jet to induce screech and greatly enhance the jet mixing. Although screech and mixing noise levels are increased, the enhanced mixing moves the source locations upstream and may make an enclosed system more amenable to noise reduction using wall acoustic treatment.

Author (revised by AIAA)

Jet Aircraft Noise; Noise Reduction; Jet Mixing Flow; Nozzle Geometry; Supersonic Jet Flow

19980021489

Instability modes excited by natural screech tones in a supersonic rectangular jets

Raman, Ganesh, Sverdrup Technology, Inc., USA; Rice, Edward J., NASA Lewis Research Center, USA; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4321; Copyright; Avail: Aeroplus Dispatch

The evolution of hydrodynamic instability modes self-excited by harmonically related natural screech tones was experimentally investigated. The hydrodynamic instability mode observed in the shear layer at the screech frequency was observed to be antisymmetric (sinuous) about the smaller dimension of the jet, whereas its harmonic was observed to be symmetric (varicose). The nearfield noise measurements indicated that the radiated screech tone noise was out-of-phase on either side of the small jet dimension whereas its harmonic was in-phase over the same region. The hydrodynamic instability modes occurring at the screech frequency and its harmonic satisfied the conditions for resonance. Detailed measurements of the coherent wave evolution in the streamwise and spanwise directions indicated that strong spanwise variations were present beyond $x/h = 8$. Details of the screech noise radiated by the coherent instability modes are presented.

Author (revised by AIAA)

Supersonic Jet Flow; Flow Geometry; Flow Stability; Shear Layers; Jet Aircraft Noise

19980021493

Computation of the BVI noise for the AH-1/OLS model rotor in forward flight with taking into account the fuselage

Schaffar, M., French-German Research Inst., France; Haertig, J., French-German Research Inst., France; Gnemmi, P., French-German Research Inst., France; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4333; Copyright; Avail: Aeroplus Dispatch

The vortex lattice method is here used to derive the noise generated by blade-vortex interaction, in the case of the presence of a fuselage, for the AH-1/OLS model rotor. The results thus obtained are compared with those for a fuselageless case of the same rotor. The fuselage is noted to reduce rotor thrust by 7 percent, while increasing rotor efficiency by 8 percent and changing the blade/vortex; the retreating blade/wake interaction and its associated noise emissions are also increased.

AIAA

Blade-Vortex Interaction; Vortex Lattice Method; Fuselages; Rotor Blades

19980021494

Aerodynamics and acoustics of rotor blade-vortex interactions - Analysis capability and its validation

Yu, Yung H., NASA Ames Research Center, USA; Tung, Chee, NASA Ames Research Center, USA; Gallman, Judith, NASA Ames Research Center, USA; Splettstoesser, W. R., DLR, Germany; Schultz, Klaus J., DLR, Germany; van der Wall, Berend, DLR, Germany; Spiegel, Pierre, ONERA, France; Rahier, Gilles, ONERA, France; Michea, Bertrand, ONERA, France; Costes, Michel, ONERA, France; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4332; Copyright; Avail: Aeroplus Dispatch

As part of an international cooperative program, several aerodynamic and acoustic prediction codes have been recently developed to understand the rotor blade-vortex interaction (BVI) noise. Furthermore, a joint validation activity of these prediction codes was performed with the blade surface pressure and acoustic data taken in the DNW with the 1/7-scale model AH-1 OLS blades. Careful attention has been given to the detailed flow field, especially wake structures during blade-vortex interactions, including

miss distance between vortex and blade, vortex core size, and tip vortex trajectories. The results of flow field including wake systems from various prediction codes show some quantitative differences, but the acoustic results using these calculated airload as inputs compare reasonably well with test data.
Author (AIAA)
Rotor Blades; Blade-Vortex Interaction; Aerodynamic Noise; Aeroacoustics; Noise Prediction (Aircraft)

19980021495
Prediction of blade-vortex interaction noise with applications to higher harmonic control
Gallman, Judith M., NASA Ames Research Center, USA; Tung, Chee, NASA Ames Research Center, USA; Yu, Yung H., NASA Ames Research Center, USA; Low, Scott L., California Polytechnic State Univ., San Luis Obispo; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4331; Copyright; Avail: Aeroplus Dispatch

In order to determine how well higher harmonic control of rotor blade pitch reduces blade-vortex interaction noise, efforts have been increased to improve the prediction of both the surface aerodynamic pressure and the far-field acoustic pressure of rotor blade-vortex interaction. The prediction efforts involve using CAMRAD/JA to determine the vortex trajectory and rotor inflow angles. This information is then used in FPR to determine the aerodynamic surface pressures. RAPP uses these aerodynamic surface pressures to predict the far-field acoustic pressure. In this paper, these analytical tools are discussed, and results for blade-vortex interaction noise without higher harmonic control are compared to experimental data. The predictions compare well enough to the experimental data to assume that a first look at how higher harmonic control of blade pitch affects BVI noise can be computed using this method.
Author (revised by AIAA)
Blade-Vortex Interaction; Harmonic Control; Noise Prediction (Aircraft); Aerodynamic Noise

19980021500
Two-dimensional sound intensity analysis of jet noise
Jaeger, Stephen M., NASA Ames Research Center, USA; Allen, Christopher S., NASA Ames Research Center, USA; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4342; Copyright; Avail: Aeroplus Dispatch

A two-dimensional sound intensify probe was developed at NASA Ames Research Center to measure the acoustic field radiated by jet plumes. The probe was used to measure the sound intensity components in two orthogonal directions to provide the sound intensity vector in the plane of the probe. The sound intensity analysis determined the radiated acoustic field and noise source locations of a 4 inch jet installed in the National Full-scale Aerodynamics Complex (NFAC) Anechoic Chamber. The results confirmed established jet noise trends and compared well with dual-sideline cross-correlation measurements taken during the same test.
Author (AIAA)
Jet Aircraft Noise; Noise Intensity; Anechoic Chambers; Noise Measurement

19980021502
Application of the finite element method to fuselage scattering of aeroacoustic noise fields
Eaton, J. A., Univ. College, Ireland; Regan, B. A., Univ. College, Ireland; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4339; Copyright; Avail: Aeroplus Dispatch

In this paper the FEM is considered and found to offer fundamental advantages over the more popular BEM in modeling fuselage scattering of aeroacoustic noise fields. With FEM, however, the data storage requirements become very large for 3D problems involving realistic geometries and frequency ranges. This obstacle is addressed here at several levels. The extent of the mesh is reduced using infinite elements; second-order serendipity elements are chosen for efficiency; the data are manipulated using a novel sparse storage scheme; and a fast iterative complex solver is developed. This new finite element scheme enables large problems to be tackled using relatively modest computing facilities. Application of the code is illustrated by comparison with classical analytical solutions for plane wave scattering from a sphere.
Author (revised by AIAA)
Fuselages; Aeroacoustics; Finite Element Method; Acoustic Scattering; Noise Propagation

19980021722
Vibration and acoustic radiation of thin-walled structures under aerodynamic excitation
Efmitsov, B. M., TsAGI, Russia; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4382; Copyright; Avail: Aeroplus Dispatch

An analysis is conducted of the phenomena defining thin-wall structure vibrations and acoustic radiation, under excitation by either uniform or largely nonuniform fields of aerodynamic pressure fluctuation. Attention is given to unique, latent resonances which are activated at determinable points in the relationship between nonuniformity, pressure fluctuation field phase velocity, structural elastic wavelength, and propagation velocity.
AIAA
Fuselages; Thin Walls; Vibration Measurement; Sound Waves; Aeroacoustics

19980021847
A technique for the prediction of propeller induced acoustic loads on aircraft surfaces
Lim, T. B., Georgia Inst. of Technology, Atlanta, USA; Sankar, L. N., Georgia Inst. of Technology, Atlanta; Hariharan, N., Georgia Inst. of Technology, Atlanta; Reddy, N. N., Lockheed Aeronautical Systems Co., USA; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4340; Copyright; Avail: Aeroplus Dispatch
A computational aeroacoustics (CAA) based methodology for the prediction of acoustic loading on aircraft surfaces due to noise sources such as propellers is described. In this approach, the nonlinear flow field in the vicinity of the sources is modeled using the 3D unsteady Navier-Stokes equations. In regions away from the source, the linearized form of the Euler equations is solved. Numerical results for several classical acoustics problems are presented to validate the CAA formulation. Results are also presented for an isolated SR-7A propeller and compared with experiments. Finally, preliminary results are presented for the acoustic loading over a fuselage, where the noise source is modeled as a compact monopole.
Author (AIAA)
Propeller Noise; Noise Prediction (Aircraft); Acoustic Propagation; Aircraft Structures

19980021848
Experimental investigation on 2D blade-vortex-interaction-noise
Obermeier, F., Max-Planck-Inst. fuer Stroemungsforschung, Germany; Schuermann, O., Max-Planck-Inst. fuer Stroemungsforschung, Germany; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4334; Copyright; Avail: Aeroplus Dispatch
To improve the understanding of the basic sound generation mechanisms due to 2D compressible vortex airfoil interaction, the flow field close to the airfoil is visualized, and simultaneous time histories of pressure in the near field are taken. Three fundamental mechanisms, compressibility wave, transonic wave, and trailing edge wave, are studied in detail by variation of the angle of attack of the airfoil (0-10 deg), the flow Mach number (0.6-0.8), and the airfoil shape (NACA0012 and NACA23012). The experimental results are compared with a numerical simulation.
Author (revised by AIAA)
Blade-Vortex Interaction; Sound Generators; Two Dimensional Flow; Airfoil Profiles; Transonic Flow

19980021855
Experimental and numerical studies of the aeroacoustics of axisymmetric supersonic inlets
Detwiler, K. P., Virginia Polytechnic Inst. and State Univ., Blacksburg, USA; Yuan, Z., Virginia Polytechnic Inst. and State Univ., Blacksburg; Ng, W. F., Virginia Polytechnic Inst. and State Univ., Blacksburg; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4372; Copyright; Avail: Aeroplus Dispatch
A series of experiments were conducted at an outdoor facility to evaluate the aerodynamic and acoustic performance of a supersonic inlet with a modified auxiliary door geometry. A 1/14 scale model of an axisymmetric mixed-compression supersonic inlet designed for civil transportation was used in conjunction with a 10.4 cm turbofan engine simulator to test a new auxiliary door geometry designed to reduce engine fan noise radiated to the forward sector at conditions similar to that of a real aircraft engine during takeoff. The flow distortion at the fan face was reduced by modifying the auxiliary inlet doors. The new door geometry uses door passages with increased circumferential span to improve the distribution of the flow entering through the doors. The results show the new door geometry is successful in reducing circumferential distortion of the flow Mach number near the fan face by a factor of 2.3 compared to a baseline configuration. In addition. far field radiation of the blade passing frequency tone and overall noise is reduced by an average of 4 dB in the forward sector.
Author (revised by AIAA)
Aeroacoustics; Axisymmetric Flow; Supersonic Inlets; Aircraft Noise; Turbofan Engines

19980021858

Stator loading reduction through active aerodynamic control

Simonich, John C., United Technologies Research Center, USA; Chi, Ray M., United Technologies Research Center, USA; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4353; Copyright; Avail: Aeroplus Dispatch

An investigation on the use of active aerodynamic control to reduce stator loading and vibration has been conducted. This is an extension of a program in which a computer-controlled trailing edge flap was used to reduce noise generated during a 2D blade-gust interaction. The reductions in unsteady blade surface pressures responsible for the noise reduction were evaluated and the associated reductions in loading were quantified. The unsteady lift was directly measured and phase averaged unsteady lift was also determined by integrating unsteady surface pressures. An analytic effort employed a 3D computer code to predict surface pressures created by an actively controlled flap system and was used to estimate the required flap motion to cancel the unsteady lift. This analysis was also used to investigate the use of a split flap to control unsteady moments created by swept gusts. The unsteady lift on the stator was reduced experimentally up to 15 dB for the fundamental frequency and 8 dB for the first harmonic.

Author (AIAA)

Stators; Rotor Aerodynamics; Aerodynamic Loads; Unsteady Aerodynamics; Active Control

19980021862

A modeling of the noise from simple co-axial jets

Fisher, M. J., Southampton Univ., UK; Preston, G. A., Southampton Univ., UK; Bryce, W. D., Bryce Research, UK; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4413; Copyright; Avail: Aeroplus Dispatch

The work described in this report forms a portion of an on-going fundamental study of co-axial jet noise both statically and in flight. Three principal noise-producing regions are identified and their mean flow and turbulence characteristics classified from published data. The noise production from each region is then calculated using single jet prediction methods for flows of similar mean velocity and turbulence profiles. The initial test of this prediction scheme has been conducted by comparison with data from an unheated, co-planar, co-axial jet configurations. The agreement, in terms of third-octave spectral predictions, is significantly better than 1 dB over a wide range of both angle of observation and velocity ratio.

Author (AIAA)

Coaxial Flow; Jet Flow; Noise Prediction; Turbulent Flow; Aircraft Noise

19980021863

Turbulent mixing noise from supersonic jets

Tam, Christopher K. W., Florida State Univ., Tallahassee, USA; Chen, Ping, Florida State Univ., Tallahassee; Oct. 1993; In English

Contract(s)/Grant(s): NAG1-421

Report No.(s): AIAA Paper 93-4408; Copyright; Avail: Aeroplus Dispatch

There is now a substantial body of theoretical and experimental evidence that the dominant part of the turbulent mixing noise of supersonic jets is generated directly by the large turbulence structures/instability waves of the jet flow. It is argued that the instability wave spectrum of the jet may be regarded as generated by stochastic white noise excitation at the nozzle lip region. The reason why the excitation has white noise characteristics is that near the nozzle lip region the flow in the jet mixing layer has no intrinsic length and time scales. The present stochastic wave model theory of supersonic jet noise contains a single unknown multiplicative constant. Comparisons between the calculated noise directivities at selected Strouhal numbers and experimental measurements of a Mach 2 jet at different jet temperatures have been carried out. Favorable agreements are found.

Author (revised by AIAA)

Turbulent Mixing; Supersonic Jet Flow; Jet Aircraft Noise; Stochastic Processes

19980021864

Cruise noise measurements of a scale model Advanced Ducted Propulsor

Dittmar, James H., NASA Lewis Research Center, USA; Hughes, Christopher E., NASA Lewis Research Center, USA; Bock, Lawrence A., Pratt & Whitney Group, USA; Hall, David G., Sverdrup Technology, Inc., Lewis Research Center Group, USA; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4400; Copyright; Avail: Aeroplus Dispatch

A scale model Advanced Ducted Propulsor (ADP) was tested in NASA Lewis Research Center’s 8- by 6-Foot Wind Tunnel to obtain acoustic data at cruise conditions. The model was tested with three inlet lengths. The model has 16 rotor blades and 22 stator vanes, which results in a cut-on condition with respect to rotor-stator interaction noise. Comparisons of the noise directivity

of the ADP with that of a previously tested high-speed unducted propeller showed that the ADP peak blade passing tone was about 30 dB below that of the propeller and therefore should not present a cabin or enroute noise problem. The maximum blade passing tone first increased with increasing helical tip Mach number, peaked, and then decreased at a higher Mach number. The ADP tests with the shortest inlet showed more noise in the inlet arc than did tests with either of the other two inlet lengths.
Author (revised by AIAA)
Aircraft Noise; Noise Measurement; Shrouded Propellers; Aeroacoustics; Engine Inlets

19980022094

Noise levels from a model turbofan engine with simulated noise control measures applied

Hall, David G., Sverdrup Technology, Inc., USA; Woodward, Richard P., NASA Lewis Research Center, USA; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4401; Copyright; Avail: Aeroplus Dispatch

This paper presents a study of estimated full-scale noise levels based on measured levels from the Advanced Ducted Propeller (ADP) subscale model. Testing of this model was performed in the NASA Lewis Low Speed Anechoic Wind Tunnel at a simulated takeoff condition of Mach 0.2. Effective Perceived Noise Level (EPNL) estimates for the baseline configuration are documented in this report, and used as the control case in a study of the potential benefits of two categories of noise control. The effect of active noise control is evaluated by artificially removing various rotor-stator interaction tones. Passive noise control is simulated by applying a notch filter to the wind tunnel data. Cases with both techniques are included to evaluate hybrid active-passive noise control. The results for EPNL values are approximate because the original source data was limited in bandwidth and in sideline angular coverage. The main emphasis is on comparisons between the baseline and configurations with simulated noise control measures.
Author (AIAA)
Turbofan Engines; Noise Prediction; Effective Perceived Noise Levels; Shrouded Propellers; Active Control

19980022097

Discrete tone reduction control on a two dimensional wing

Nakashima, Shinji, Mitsubishi Electric Corp., Central Research Lab., Japan; Otsuta, Katsuhisa, Mitsubishi Electric Corp., Central Research Lab., Japan; Akishita, Sadao, Ritsumeikan Univ., Japan; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4395; Copyright; Avail: Aeroplus Dispatch

The active noise control of discrete tones generated in a uniform jet flow on a 2D wing was investigated. The discrete tone was characteristic of the noise caused by a self-excited feedback loop formed by the acoustic field and the unstable boundary layer. In the boundary layer on the suction side, the velocity fluctuation increased at an exponential rate and moved to the trailing edge. We conducted an active control experiment using a flap-driven with piezoceramic levers which can vibrate with the delayed phase from the signal of the velocity fluctuation on the suction side. When the flap motion delayed the pressure fluctuation at the trailing edge by a phase angle of 180 deg, the discrete tone noise was reduced by a maximum of about 7 dB, the flow fluctuation intensities in the boundary layer on the suction side were reduced to about a half, and the correlation area of the flow fluctuation at the trailing edge decreased. This confirms that discrete tone generation caused by the feedback loop and the discrete tone is actively reduced by trailing edge control.
Author (revised by AIAA)
Jet Flow; Wings; Active Control; Noise Reduction; Sound Fields

19980022103

Jet noise predictions using a k-epsilon turbulence model

Bailly, C., Electricite de France, Clamart, France; Bechara, W., Electricite de France, Clamart; Lafon, P., Electricite de France, Clamart; Candel, S., Paris, Ecole Centrale des Arts et Manufactures, France; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4412; Copyright; Avail: Aeroplus Dispatch

This paper deals with the prediction of the noise radiated by subsonic and supersonic jets using methods derived from the Lighthill acoustic analogy. The jet noise models of Ribnet and Goldstein (mixing noise) and Ffowcs-Williams (Mach wave noise) are adapted and used in combination with aerodynamic data obtained with k-epsilon turbulence codes. The results are compared to experimental data. A good agreement is found for subsonic as well as supersonic Mach numbers.
Author (revised by AIAA)
Supersonic Aircraft; Aircraft Engines; Noise Prediction; K-Epsilon Turbulence Model; Turbulent Flow; Sound Waves

19980022104

Supersonic elliptic jet noise

Morris, Philip J., Pennsylvania State Univ., University Park, USA; Bhat, Thonse R. S., NASA Langley Research Center, USA; Oct. 1993; In English

Contract(s)/Grant(s): NAG1-1047

Report No.(s): AIAA Paper 93-4409; Copyright; Avail: Aeroplus Dispatch

This paper describes predictions of the noise radiation by large-scale structures or instability waves in supersonic elliptic jets. The properties of the instability waves, the mean flow and density in the jet, and the pressure field outside the jet are found. The instability wave and the acoustic solutions are expanded in a series of trigonometric and Hankel functions and are connected on the basis of the method of matched asymptotic expansions. Expressions for both the near and far fields are obtained. Calculations are performed for a Mach number 1.5 elliptic jet of aspect ratio 3:1. Both a cold and a heated jet with static temperature ratio 2 are considered. The results indicate that the instability wave noise radiation mechanism is relatively weak for the cold jet. For the heated jet, the relative noise radiation levels for the different modes of instability are determined. The motion flapping about the major axis is found to be dominant.

Author (AIAA)

Supersonic Jet Flow; Jet Aircraft Noise

19980022113

HELINOISE - The European Community rotor acoustics research program

Heller, Hanno, DLR, Germany; Splettstoesser, Wolf, DLR, Germany; Kloeppel, Valentin, Eurocopter Deutschland, Germany; Cenedese, Fausto, Agusta S.p.A., Italy; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4358; Copyright; Avail: Aeroplus Dispatch

Research efforts conducted under the aegis of HELINOISE furnish detailed information on both the radiated sound field and the unsteady surface pressure characteristics of helicopter main rotor blades over a wide range of operational parameters. Such data are crucial for the validation and improvement of rotor noise acoustic and aerodynamic prediction codes. Attention is given to laser-lightsheet rotor flow visualization techniques.

AIAA

Helicopters; Rotor Aerodynamics; Sound Fields; Noise Prediction; Aeroacoustics

19980022114

Study of helicopter noise signals using time-frequency analysis methods

Siegert, R. U., Ecole Nationale Superieure d'Ingenieurs de Constructions Aeronautiques, France; Nouals, C., Ecole Nationale Superieure d'Ingenieurs de Constructions Aeronautiques, France; Damongeot, A., Eurocopter France, Marignane; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4357; Copyright; Avail: Aeroplus Dispatch

This paper is concerned with the application of the wavelet transform on experimental helicopter noise signals recorded in a 60 approach flight procedure. These signals are composed of quasi-periodical, slowly time-varying components as well as of highly nonstationary components due to blade-vortex interactions or high blade tip speed effects. The aim is to point out the advantages of 2D analysis methods. The wavelet analysis illustrates the chronological evolution of different sound sources which can then be characterized in terms of their time-frequency signatures. These signatures are used for local filtering in the time-frequency domain. Consequently single signal components can be isolated and treated separately without affecting the signal or the spectrum outside of the filtered regions. This method allows a quantitative identification of non-stationary phenomena.

Author (revised by AIAA)

Aircraft Noise; Helicopters; Wavelet Analysis; Signal Analysis; Aeroacoustics

19980022118

Active control of wake/blade-row interaction noise

Kousen, Kenneth A., United Technologies Research Center, USA; Verdon, Joseph M., United Technologies Research Center, USA; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4351; Copyright; Avail: Aeroplus Dispatch

This paper describes an analytical/computational approach for controlling the noise generated by wake/blade-row interaction through the use of antisound actuators on the blade surfaces. A representative two-dimensional section of a fan stage, composed of an upstream fan rotor and a downstream fan exit guide vane (FEGV), is examined. An existing model for the wakes generated by the rotor is analyzed to provide realistic magnitudes for the vortical excitations imposed at the inlet to the FEGV. The acoustic

response of the FEGV is determined at multiples of the blade passing frequency (BPF) by using the linearized unsteady flow analysis, LINFLO. An analysis then is presented to determine the complex amplitudes required for the control surface motions to best reduce the far-field noise. The effectiveness of the control is measured by the decrease in the circumferentially averaged sound pressure level (SPL), which is minimized by a standard least-squares procedure.
Author (AIAA)
Turbofan Engines; Active Control; Turbulent Wakes; Rotor Body Interactions; Vortices; Noise Reduction

19980022121
Aeroacoustic similarity of centrifugal turbomachinery of different geometries
Tetu, Lee G., Pennsylvania State Univ., University Park, USA; Thompson, Donald E., Pennsylvania State Univ., University Park; McLaughlin, Dennis K., Pennsylvania State Univ., University Park; Oct. 1993; In English
Contract(s)/Grant(s): N00014-93-I-0374; N00014-93-I-0011
Report No.(s): AIAA Paper 93-4371; Copyright; Avail: Aeroplus Dispatch

An experimental study is conducted of the acoustics and aerodynamics of a five-bladed, highly back-swept centrifugal impeller; its radiated noise is compared with that of a similar-diameter, seven-bladed impeller, and it is established that their source spectra characteristics are similar. Two distinct noise-generation phenomena are noted: (1) the interaction of the impeller blade trailing edges with a highly coherent rotating discharge instability, and (2) trailing-edge interaction with turbulence that is convected by pairs of adjacent blades.
AIAA
Aeroacoustics; Centrifugal Compressors; Propeller Blades; Propeller Noise

19980022361
Active structural acoustic control of noise transmission through double panel systems
Carneal, James P., Virginia Polytechnic Inst. and State Univ., Blacksburg, USA; Fuller, Chris R., Virginia Polytechnic Inst. and State Univ., Blacksburg; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4421; Copyright; Avail: Aeroplus Dispatch

This work is concerned with an experimental investigation of active control of reverberant sound transmission through double panel systems. The technique used is the Active Structural Acoustic Control (ASAC) approach where control inputs, in the form of piezoelectric actuators, were applied to the structure while the radiated pressure field was minimized. Results indicate the application of control inputs to the radiating panel resulted in greater transmission loss (TL) due to its direct effect on the nature of the structural-acoustic coupling between the radiating panel and the receiving chamber. Increased control performance was seen in a double panel system consisting of a stiffer radiating panel with a lower modal density. As expected, more effective control of a radiating panel excited on-resonance is achieved over one excited off-resonance. In particular the results demonstrate that it is possible to take advantage of the double panel behavior to enhance control performance, and validate the ASAC approach for double panel systems.
Author (AIAA)
Active Control; Sound Transmission; Acoustic Attenuation; Panels; Aircraft Noise; Noise Reduction

19980022373
Acoustic characteristics of propfans
Kuznetsov, V. M., TsAGI, Russia; Ganabov, V. I., TsAGI, Russia; Krymova, L. S., TsAGI, Russia; Makashov, S. Yu., TsAGI, Russia; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4444; Copyright; Avail: Aeroplus Dispatch

Results are presented from an experimental investigation of propfan acoustics that encompasses acoustic loading distributions on a hard surface, taking into acount the sources that determine the forcing action of the blades on their environment. Attention is given to the influence of aerodynamic and geometric parameters of propfans, and their working conditions, on the radiated acoustic field. Passenger transport-related propfan noise problems are discussed.
AIAA
Propeller Fans; Aeroacoustics; Sound Pressure; Load Distribution (Forces); Sound Fields; Aircraft Noise

19980022375
A rapid method for the computation of sonic booms
Plotkin, Kenneth J., Wyle Labs., USA; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4433; Copyright; Avail: Aeroplus Dispatch

An efficient method is presented for computing sonic booms from maneuvering aircraft in an arbitrary, horizontally stratified, windless atmosphere. The method, denoted SBORT (Sonic Boom Optimized Ray Tracing), utilizes tables of ray shape functions. Once a table has been prepared for a given atmosphere, ray tube areas are computed via table look-ups and algebraic relations, rather than numeric quadratures for each ray path. Computation times for this method are one to two orders of magnitude faster than for traditional sonic boom procedures.
Author (AIAA)
Sonic Booms; Sound Transmission; Noise Prediction; Computer Techniques

19980022376

Effect on inlet reflections on fan noise radiation

Meyer, H. D., United Technologies Corp., Hamilton Standard Div., USA; Oct. 1993; In English
Contract(s)/Grant(s): NAS3-25952
Report No.(s): AIAA Paper 93-4427; Copyright; Avail: Aeroplus Dispatch

This paper is an initial investigation into the effect of inlet reflections on turbofan noise radiation. The purpose is to discover whether the contribution from reflected waves is sufficient to warrant the extra complexity of including reflection in prediction methodologies. In making evaluations, two noise prediction codes have been used a turbofan source noise generation code (BBN/PWC), and an acoustic radiation code (ARC) which predicts far-field acoustic radiation from a turbofan engine inlet. to first evaluate reflection, the ARC alone was used. Then a coupled code using both the ARC and a modified version of the BBN/PWC, which accepts reflected waves and generates updated stator loading, was developed and used for exploratory runs. Results, thus far, have shown that reflection from the inlet is significant in bands of frequencies about modal cutons. Reflected amplitudes are high enough to indicate that full coupling of the source and radiation fields is needed for accurate noise predictions.
Author (AIAA)
Turbofans; Engine Inlets; Inlet Flow; Noise Prediction; Sound Fields; Wave Reflection

19980022377

Wavenumber active structural acoustic control for smart structures

Mathur, Gopal P., McDonnell Douglas Corp., USA; Tran, Boi N., McDonnell Douglas Corp., USA; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4422; Copyright; Avail: Aeroplus Dispatch

A wavenumber based active structural acoustic control (ASAC) approach for reducing sound radiation and transmission through planar structures is presented. Active structural acoustic control test results of a baffled panel subjected to acoustic excitation, with and without active control conditions, are discussed. Measured sound intensity and wavenumber-frequency spectra are used to determine the sound power transmitted through the panel for estimating improvement in panel transmission loss due to the wavenumber based ASAC method. The wavenumber ASAC method is shown to provide sound transmission loss improvement comparable to the conventional ASAC method with microphone as error sensors.
Author (AIAA)
Smart Structures; Active Control; Acoustic Attenuation; Panels; Structural Vibration; Aircraft Noise

19980022410

On vibration and sound radiation of aircraft panel equipped with dynamic vibration absorbers

Sun, Zhaohui, Northwestern Polytechnical Univ., China; Dai, Yang, Northwestern Polytechnical Univ., China; Wang, Chong, Northwestern Polytechnical Univ., China; Sun, Jincai, Northwestern Polytechnical Univ., China; Northwestern Polytechnical University, Journal; Oct. 1993; ISSN 1000-2758; Volume 11, no. 4, pp. 470-475; In Chinese; Copyright; Avail: Aeroplus Dispatch

Dynamic vibration absorbers attached to aircraft panels are effective in reducing propeller-induced cabin noise. Modal analysis is here used to systematically analyze vibration and sound radiation of an aircraft panel, and derive formulas for the vibration reduction and noise reduction obtainable when a dynamic vibration absorber is employed. These formulas make it possible to discuss the effects of various parameters and the installation position of an absorber on vibration and noise reduction. General principles are offered for selecting proper values of parameters and proper position of installation. Laboratory tests show that theoretical predictions agree well with test data.
Author (revised by AIAA)
Aircraft Structures; Curved Panels; Structural Vibration; Vibration Isolators; Sound Waves

19980022445 Harris, Miller, Miller and Hanson, Inc., Burlington, MA USA

Federal Interagency Committee on Aviation Noise ***Annual Report, Jan. 1994 - Dec. 1995***

Miller, Robert L., Harris, Miller, Miller and Hanson, Inc., USA; Eagan, Mary Ellen, Harris, Miller, Miller and Hanson, Inc., USA; Dec. 1997; 145p; In English

Contract(s)/Grant(s): F33615-89-C-0574; AF Proj. 7757

Report No.(s): AD-A334216; AL/OE-TR-1997-0144; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The Federal Interagency Committee on Aviation Noise (FICAN) was formed in 1993 to provide forums for debate over needs for future aviation noise research and to encourage new development efforts in this area. All Federal agencies concerned with aviation noise are represented on the Committee, including the Department of Defense, the Department of the Interior, the Department of Transportation, the Environmental Protection Agency, the National Aeronautics and Space Administration, and the Department of Housing and Urban Development. FICAN's 1994 Annual Report provides information on FICAN activities during calendar year 1994, including: four FICAN meetings, publication of a Report on Aviation Noise Research Conducted by U. S. Federal Agencies, a public forum, and attendance and staffing of an exhibition booth at the Third Annual Airports Council International North America Conference.

DTIC

Airports; Environment Protection; Noise Pollution; Aircraft Noise

19980022480

Noise directivity of unducted counter rotating propfans

Loelgen, Th., Aachen, Rheinisch-Westfaelische Technische Hochschule, Germany; Neuwerth, G., Aachen, Rheinisch-Westfaelische Technische Hochschule, Germany; Oct. 1993; In English

Contract(s)/Grant(s): DFG-Sta-174/8-1

Report No.(s): AIAA Paper 93-4441; Copyright; Avail: Aeroplus Dispatch

The noise emission of counter-rotating propfans and propellers (CRP) was studied theoretically and by experiments giving special emphasis to the noise directivity due to the aerodynamic interaction between the propellers. Experiments were conducted using a 5 x 6 bladed CRP with a diameter of 0.6 m in an open-jet wind tunnel for take-off and landing conditions. CRP noise emission was found to be dominated by the noise due to the aerodynamic interactions. This so-called interaction noise is mainly radiated in upstream and downstream direction. The thrust ratio between forward and aft propeller has a strong influence on the directivity. A system of computer programs has been developed to predict the emitted noise of CRP. It includes the modelling of the CRP flow field and the calculation of the unsteady blade loads due to the aerodynamic interaction. These theoretical results are in good agreement with measured noise levels and sound spectra.

Author (AIAA)

Propeller Fans; Aeroacoustics; Flow Distribution; Aircraft Noise; Noise Prediction

19980022481

Effects of fuselage on propeller noise

Li, Xiao-Dong, Beijing Univ. of Aeronautics and Astronautics, China; Sun, Xiao-feng, Beijing Univ. of Aeronautics and Astronautics, China; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4442; Copyright; Avail: Aeroplus Dispatch

A theoretical model for multiple propeller noise prediction including fuselage reflecting effects is presented in this paper. In this model, fuselage is assumed as an infinitely long rigid cylinder. According to image principle, the image in the cylinder will be a deformed propeller because of the nonlinear transformation. After making some approximations about image propeller, the sound field of propeller is obtained by solving the Ffowcs Williams-Hawkings equation in time domain. Numerical results show that the sound field emitted by propeller will vary with different fuselage curvature. On the other hand, some calculations also show that the mechanism of interference between multiple propellers may be used for noise control on the fuselage surface.

Author (revised by AIAA)

Fuselages; Propellers; Noise Prediction; Sound Fields; Sound Pressure

19980022485

Airframe noise radiation from axisymmetric bodies at high subsonic speeds

Revell, J. D., Lockheed Advanced Development Co., USA; Balena, F. J., Lockheed Advanced Development Co., USA; Lackey, D. F., Lockheed Advanced Development Co., USA; Hickmon, F. O., Lockheed Advanced Development Co., USA; Feltz, E. P., Lockheed Advanced Development Co., USA; Oct. 1993; In English

Report No.(s): AIAA Paper 93-4434; Copyright; Avail: Aeroplus Dispatch

Airframe noise has been recognized as a floor limiting the benefits of engine noise since the 1970's, particularly at the landing approach certification point for commercial transport aircraft. The research in this paper demonstrates the existence of noise radiation from axisymmetric bodies such as fuselages and nacelles, which are not included in the well-known NASA/ANOPP noise prediction code. Experiments were conducted inside a high-speed anechoic wind tunnel (HSANWT) having a low turbulence level. Measurements were made in the acoustic field, using a streamlined probe microphone within the flow. Comparisons between measurements, with the model installed, and in the empty test section demonstrate a significant SNR over a range of Mach numbers and directivity angles. Methods of correcting the data for wind tunnel Mach number effects are discussed.
Author (AIAA)
Airframes; Aircraft Noise; Subsonic Speed; Noise Prediction; Noise Measurement

19980022490
A computational study of the aeroacoustics of rotors in hover
Baeder, James D., Maryland Univ., College Park, USA; Gallman, Judith M., NASA Ames Research Center, USA; Yu, Yung H., NASA Ames Research Center, USA; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4450; Copyright; Avail: Aeroplus Dispatch
The Euler/Navier-Stokes solver, the linear Kirchhoff formulation, and the Ffwocs Williams and Hawkings formulation are here used to examine the noise from low-thrusting rotors in hover for a wide range of tip Mach numbers and various blade planforms. It is demonstrated that, with special attention being given to the numerical solution procedures, a purely CFD method can calculate noise for the present conditions both in-plane and out-of-plane. The computed CFD solutions presented furnish a considerable data-base for validating simpler aeroacoustics methods.
AIAA
Aeroacoustics; Rotor Aerodynamics; Unsteady Aerodynamics; Computational Fluid Dynamics; Noise Prediction

19980022492
Acoustics predictions and measurements on a transonic propeller
Meijer, Staffan, Flygtekniska Forsoksanstalten, Sweden; Lindblad, Ingemar A. A., Flygtekniska Forsoksanstalten, Sweden; Wallin, Stefan, Flygtekniska Forsoksanstalten, Sweden; Donnelly, R. P., Dowty Aerospace Propellers, UK; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4445; Copyright; Avail: Aeroplus Dispatch
Acoustic predictions for a scale model research propeller R311 using a Kirchhoff formulation and a completely linear prediction method have been compared with acoustic measurements. The nonlinear prediction method uses an Euler solver to generate flowfield values on the surfaces of a finite length cylinder surrounding the propeller. The values on the cylinder are used as boundary data for an outer linear acoustic problem by Kirchhoff's method. Four test cases with helical tip Mach numbers in the range 0.90 to 1.08 were investigated. In the first case where M(hel) was 0.90 the two acoustic prediction methods agree well with the measurement results. For the higher values of M(hel) the sound field was much better predicted using the Kirchhoff method. The results also indicate that the linear prediction method overpredicts the increase in sound level with increasing Mach number for values of M(hel) larger than 1 whereas the Kirchhoff method has a variation with M(hel) that is in much better agreement with the measured data.
Author (revised by AIAA)
Propellers; Transonic Flight; Aeroacoustics; Noise Prediction; Wave Propagation; Diffraction

19980022707 Harris, Miller, Miller and Hanson, Inc., Burlington, MA USA
Federal Interagency Committee on Aviation Noise: Report on Aviation Noise Research Conducted by US Federal Agencies
Interim Report, Jun. 1993 - Jul. 1994
Miller, Robert L., Harris, Miller, Miller and Hanson, Inc., USA; Eagan, Mary Ellen, Harris, Miller, Miller and Hanson, Inc., USA; Dec. 1997; 108p; In English
Contract(s)/Grant(s): F33615-89-C-0574; AF Proj. 3037
Report No.(s): AD-A334209; AL/OE-TR-1997-0142; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
The Federal Interagency Committee on Aviation Noise (FICAN) was formed in 1993 to provide forums for debate over needs for future aviation noise research and to encourage new development efforts in this area. All Federal agencies concerned with aviation noise are represented on the Committee, including the Department of Defense, the Department of the Interior, the Department of Transportation, the Environmental Protection Agency, the National Aeronautics and Space Administration, and the Department of Housing and Urban Development. This report introduces current and planned research topics in aviation noise. The work summarized here represents the individual (or sometimes joint) initiatives of member agencies. Fifty-nine projects on aviation noise were identified by FICAN members. Areas of study include: investigation of new criteria for determining land use

compatibility, examination of community reactions to aircraft noise, perception of aircraft noise and how it is affected by background noise, acoustic issues associated with rotary wing aircraft, noise effects on animals, development and improvement of computer models, noise reduction technologies, improved public information materials, and structural damage effects.
DTIC
Aircraft Noise; Environment Protection; Noise Pollution; Noise Reduction

19980022891
Boom event analyzer recorder - The USAF unmanned sonic boom monitor
Lee, Robert A., USAF, Armstrong Lab., USA; Downing, J. M., USAF, Armstrong Lab., USA; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4431; Copyright; Avail: Aeroplus Dispatch

This report describes the unmanned sonic boom monitor developed by the Noise Effects Branch of the Armstrong Laboratory of the USAF. These monitors are referred to as the Boom Event Analyzer Recorders, BEARs. The BEAR captures the full waveform of impulsive acoustics events while excluding all other acoustic events. The signatures are stored in a digital format for easy retrieval and analysis. These BEAR systems have been used successfully to capture sonic boom signatures in several sonic boom field studies and have captured other impulsive events in the laboratory. This report summarizes the patented data collection algorithms, the operation procedures, data storage and retrieval routines, and the hardware and software of the BEAR systems.
Author (revised by AIAA)
Sonic Booms; Noise Meters; Acoustic Measurement

19980022895
Active control of turbulent boundary layer noise in aircraft
Thomas, D. R., Southampton Univ., UK; Nelson, P. A., Southampton Univ., UK; Oct. 1993; In English
Report No.(s): AIAA Paper 93-4423; Copyright; Avail: Aeroplus Dispatch

In this paper it is first shown that the problem of a applying active control to simply supported plate excited by a turbulent boundary layer can be presented in a form which allows the application of optimal control theory. It is shown that a simple Corcos model of the turbulent boundary layer excitation can be modeled as an ’excitation filter’. In similar fashion the radiated power can be estimated by means of a ’radiation filter’. The state space forms of the ’excitation filter’ and ’radiation filter’ can be combined with the state space model of the plate to give a system state space realization which can be used in the solution of a linear quadratic regulator problem. Optimal control analysis is then applied to the state equations and optimal reductions in the far field radiated power are obtained for various arrangements of control forces. These results give insight into the possibilities for obtaining useful reductions in turbulent boundary layer induced noise in aircraft by the application of feedback control.
Author (AIAA)
Aircraft Noise; Turbulent Boundary Layer; Acoustic Excitation; Active Control; Boundary Layer Control; Noise Reduction

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SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

19980021470
Recent developments in aviation case law
Stroud, James C., Rawle & Henderson, USA; Journal of Air Law and Commerce; Oct. 1993; ISSN 0021-8642; Volume 59, no. 1, pp. 1-75; In English; Copyright; Avail: Aeroplus Dispatch

A variety of cases decided prior to January 1, 1993 are surveyed. The cases discussed are listed under the following headings: Foreign Sovereign Immunities Act, Warsaw Convention, Federal Torts Claims Act, insurance, product liability, and Federal aviation act. Other cases discussed fall under the subject matters of Federal Aviation Administration, airports, commercial, and miscellaneous.
AIAA
Air Law; Aircraft Accidents; Sovereignty; Legal Liability

19980021483

Liberalization of restrictions on foreign ownership in U.S. air carriers - The USA must take the first step in aviation globalization

Arlington, David T., USA; Journal of Air Law and Commerce; Oct. 1993; ISSN 0021-8642; Volume 59, no. 1, pp. 133-192; In English; Copyright; Avail: Aeroplus Dispatch

It is argued that the citizenship requirement of the Federal Aviation Act of 1958 is archaic and therefore must be liberalized and adapted to the new world economy if U.S. air carriers are going to survive in the upcoming world of global competition. After a brief discussion of the history of the citizenship requirement in the 1958 Act, the Civil Aeronautics Board and DOT interpretations of this requirement are addressed, focusing on the most recent decisions in the area. Policy arguments both for and against the original proposal for a British Airways-USAir alliance are then discussed. Attention is also given to DOT's recent proposals for open skies agreements with European countries.

AIAA

Passenger Aircraft; International Law; Airline Operations; Regulations; Operating Costs

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GENERAL

19980022184 National Aerospace Lab., Tokyo, Japan

National Aerospace Laboratory Research Progress, 1996

Nayuki, Tetsuo, Editor, National Aerospace Lab., Japan; Yoshida, Makoto, Editor, National Aerospace Lab., Japan; Matsuo, Yuichi, Editor, National Aerospace Lab., Japan; 1996; ISSN 1340-5977; 146p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The role of the National Aerospace Laboratory (NAL) is to conduct research and investigations which will advance aeronautics and space technology and to provide large-scale test facilities to be shared with other governmental organizations. Since its foundation in 1955, NAL has made significant technological contributions in almost all areas related to the development of aircraft, aeroengines and rockets in Japan. Partial Contents: Space propulsion and transportation system; space technology and application; computational and experimental aerodynamics; materials and structures; control and guidance; and aircraft propulsion

Derived from text

Aerospace Engineering; Technology Utilization; Computational Fluid Dynamics; Aircraft Engines

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